Popular Science

INVENTIONS
DISCOVERIES
RADIO
AUTOMOBILES
AVIATION
HOME WORKSHOP

★ FOUNDED MONTHLY 1872

JANUARY

How to make the new and thrilling winged toboggan. *Page 72*

25 CENTS

Inventions I Hope to Make—*Edison*

No matter what set you buy, be sure the dealer puts in *genuine* Radiotrons:

UV-199	$2.50
UX-199	$2.50
UX-120	$2.50
UV-201-A	$2.50
UX-201-A	$2.50
UV-200	$2.50
UX-200	$2.50
WD-11	$2.50
WD-12	$2.50
WX-12	$2.50
UX-112	$6.50
UX-210	$9.00

Rectrons:

UX-213	$7.00
UX-216-B	$7.50

A "UX" or "WX" tube is the same as the corresponding "UV" or "WD" tube, except in the design of the base.

RCA

Radiotron UV-201-A, standard high-vacuum tube for storage battery sets.

for every

Christmas Radio Set

use only genuine RCA Radiotrons

READ all the claims of all the makers of radio sets—and then remember this when you buy—that getting what is claimed for a set depends upon the quality of the *vacuum tube* put into it. You cannot get clearness—you cannot get distance—you cannot get volume—unless the *tubes* get it. That is why it is so important to look at the base of every tube, to be sure it is a *genuine* RCA Radiotron.

A great gift for any fan—at $2.50

A radio fan will appreciate a "spare" Radiotron, just as an autoist appreciates a spare tire. But the Radiotron—a genuine RCA Radiotron—costs only $2.50. If you note what make of set a man owns, any dealer can tell you which *type* of Radiotron he uses, and you can give him exactly what he would choose for himself.

for owners of Super-Heterodynes — the new power tube

Every owner of a Radiola Super-Heterodyne can bring his set right up-to-date with the latest improvement, if you give him the new dry battery power Radiotron UX-120, and the adapter. The adapter costs but $1.50. And this new tube means great volume with better tone than ever!

RADIO CORPORATION OF AMERICA
CHICAGO NEW YORK SAN FRANCISCO

RCA-Radiotron

MADE BY THE MAKERS OF RADIOLAS

How Kolster Reveals RADIO'S "LOST CHORDS"

Model 6-C is a six tube, antenna set, loud speaker enclosed, ample space for rectifier and all batteries.

Subtle overtones now developed. A wondrous achievement in tonal perfection

Reproduction such as you've never heard before.

The climax in reception, the ideal in reproduction.

Your ear will *instantly* detect Kolster superiority.

You'll recognize a broader range of notes, all the delicate shadings and individuality.

If Zimbalist plays, it is Zimbalist—as if you were actually in the studio. There is no interference, no muffling, no exaggerations or repressions.

If the President makes a speech, if McCormack sings, if Lopez jazzes, if Godowsky plays the piano—

—whoever or whatever is broadcast is reproduced faithfully.

A Kolster neither adds to nor subtracts from broadcasting.

So now comes new reality. All the rich tonal coloring in its natural beauty—not mere sound but vivid, lifelike.

And all with simplicity. Just turn from one station to another. The Kolster has a single control. No "tricky" tuning with numerous dials. No chart of strange numbers.

Free from interference. No howls. No background noises. No overlapping of stations.

In short, the radio you've expected. The refinements you've wanted. Radio at its best.

To hear a Kolster gives a new thrill. It sets new standards.

Hear the Kolster in your own home or at a Kolster dealer's shop. Five beautiful models. De luxe, but not expensive.

A Parade of Stations

One station after another parades by as you turn the Kolster regulator.

Whatever is on the air comes in easily, perfectly.

Ⓢ

FEDERAL TELEGRAPH COMPANY
(of California)
Woolworth Building, New York City

KOLSTER RADIO

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Popular Science Monthly

The Magazine of Invention and Discovery

JANUARY, 1926; Vol. 108, No. 1

25 cents a Copy; $2.50 a Year

Published in New York City at 250 Fourth Avenue

Features in This Issue

ALL outdoors is the studio of Remington Schuyler, the noted American Indian painter; but nowhere, we think you will agree, has he portrayed the tingling thrill of winter more masterfully than in the painting on the cover of this issue. If this picture makes you want to build a winged toboggan and try it on the nearest hill, your enthusiasm will be doubled when you read the graphic description of this fascinating new winter sport by its originator. Turn to page 72.

* * *

WHETHER clothes make the man or not, it is fairly certain that spotted and shabby clothes never get a man very far. For every one who values the measure of self-respect to be drawn from a neat appearance, the article by an expert dry cleaner on page 23 holds a wealth of useful information on a little understood subject.

The autogiro, amazing flying machine, that flaps its wings like a bird, described on page 13 of this issue

AFTER all that has been said and written about memory and how to improve it, a Columbia University professor at last has really hit the nail on the head on page 26 of this issue. He offers us no short cut to perfect memory. Instead he shows us how we can manage more efficiently the marvelous filing system of our minds and so increase its working capacity.

Professor Robert S. Woodworth also cites interesting instances of men who have naturally remarkable memories.

* * *

HAVE you been caught by the hard coal shortage? There's a sure way to beat the problem, as you will learn when you turn to the article on page 34.

It tells you just how you can burn soft coal in your furnace almost, if not quite, as effectively as anthracite.

* * *

THAT often - dreamed - of achievement—vertical flight from the roofs of buildings and homes—may be brought a step nearer reality by the remarkable flying machine, the autogiro, pictured here. On page 13 you will read of its remarkable test flight.

And 200 Other Articles and Pictures, including—

And Other Timely Articles and Pictures

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, $2.50; foreign countries, $3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dunellen, N. J. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Are You Looking for

OPPORTUNITY?

Turn to Pages 120 to 150

You'll find in our new section "Money-Making Opportunities" just the Opportunity you seek!

Do you want to make money? Are you dissatisfied with your job, your salary, your future? Do you envy those who are better paid than you?

There's just one sure way to get ahead, to climb out of the small pay rut—and that way is through Training. And there are several ways to get the right kind of training for the job you want to fill—through home study from a reputable correspondence school, through technical books, or through a short course in a residence trade school.

A New Service to Readers of Popular Science Monthly

Popular Science Monthly is the meeting place for those who want training and those who are expert in giving it. Thousands of men and boys have been started on the road to greater earning power through advertisements in this magazine.

Now, as an added service to you—to make it easier for you to decide on the training you wish—we have grouped all advertisements of this kind in our new section, "Money-Making Opportunities." You'll find it on pages 120 to 150 of this issue.

It will pay you to turn to these pages—to read over carefully the advertisements of schools and books covering the field in which you are most interested—and then to act! Choose the line of work that appeals to you most, and write to the advertisers in that line for full particulars of their training.

How Thousands Have Already Won Success

Men with no experience, with little education, with nothing to help them but their own ambition to be somebody, have found success through ads in Popular Science Monthly. They saw the announcements of courses of training here. They sent the coupons, decided which offered them the best opportunity, and then, through the training they received, rose quickly to positions of responsibility and greater earning power.

It will pay you to read, "Money-Making Opportunities"

[PAGES 120 to 150]

$100 in Prizes!

FULL DETAILS OF THIS BIG OFFER AND THE WINNERS IN LAST MONTH'S CONTEST WILL BE FOUND ON PAGE 120

Clerks have become star salesmen—farm boys have become electrical experts—bookkeepers have become expert accountants. Men who had never before been able to earn more than $25 or $35 a week, are now making $50, $75, $100 and more. And they don't work half so hard. But they are *trained* men—specialists in their field—and it's trained specialist, not the unskilled and untrained worker, who gets the big money.

You Risk Nothing When You Write for Details

You can get all the facts about any Course of training advertised under "Money-Making Opportunities" without the slightest obligation to yourself.

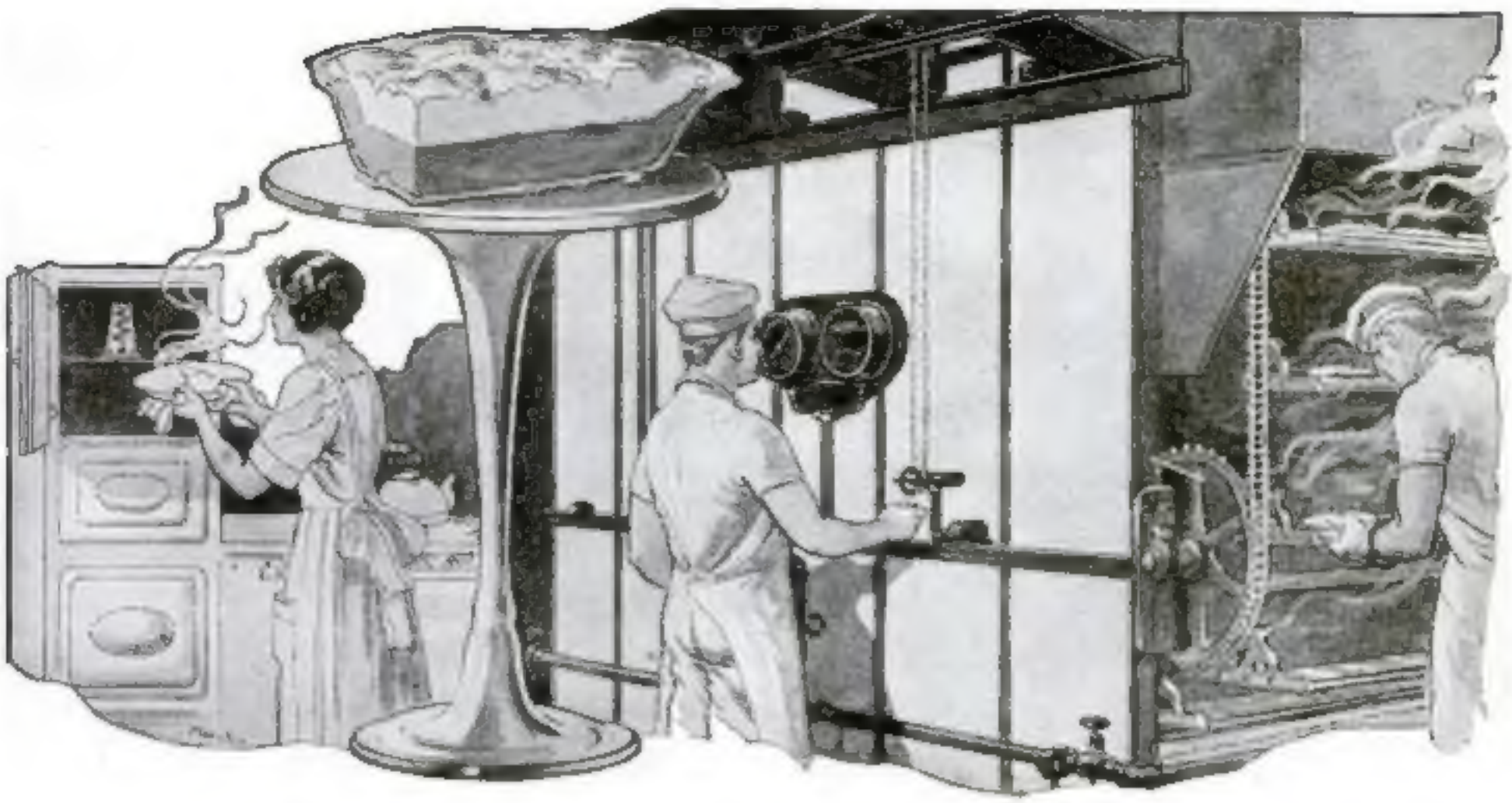
Hence you don't risk a thing when you answer an advertisement of training in Popular Science Monthly. You will lose nothing—and you open up for yourself bigger opportunities, a bright future, more and better chances to earn big pay, than you ever had before.

What Others Have Done You, Too, Can Do!

The men who found success through Popular Science ads aren't any smarter or more ambitious than you. They only had the same opportunity that you have now. They simply decided what they wanted to do—and then did it.

Make your decision today. Be a "doer"—not a "wisher." Start now to study the "Money-Making Opportunities" on pages 120 to 150 of this magazine. It may be the turning point of your life!

"What's Your Future?" Get started now on the Road to Success—*see pages 120-150*



Pies Made the Tycos Way

THOUSANDS of pies a day, hundreds of thousands a year—every one with crisp, flaky crust and the filling baked just right.

Uniformity in product, the all essential in modern baking on a quantity basis, is made possible by the use of *Tycos* Electric-Contact Temperature Control. No longer do bakers depend on the labor-wasting hand adjustments of the gas valve with the inevitable variations in temperature that means spoilage and delays in delivery. The uniformity that bakers get can be had in home baking if the Taylor Oven Thermometer is used.

Guesswork and uncertainty in baking and in every other industry employing heat processes have been eliminated by the use of *Tycos* Instruments for Indicating, Recording and Controlling Temperatures—the Sixth Sense of Industry.

If you use heat in your manufacturing processes—whether for making armor-plate or baking enamel on cuff buttons, for making rubber tires or hatching eggs or making paints, metalware, furniture or any other product that goes through heat treating processes, you need in your plant *Tycos* Instruments for Indicating, Recording and Controlling Temperatures.

To Manufacturers

Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the *Tycos* "Sixth Sense." Whatever your problem in the indicating, recording or controlling of heat, there is a *Tycos* Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or, if you prefer, our engineers will consult with you on the application of the *Tycos* Sixth Sense in your plant.

Taylor Instrument Companies

Main Office and Factory
ROCHESTER, N. Y. · · U. S. A.
Canadian Plant: *Tycos* BUILDING, TORONTO
SHORT & MASON, LTD., Manufacturing Distributors in Great Britain

Tycos—for the Home

Tycos Office Thermometers
An aid in promoting human efficiency.

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Tycos Home Set
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Wall Thermometers
To help you maintain a temperature in your house conducive to good health.

Taylor Quality Compasses
To show you the right way in unfamiliar country.

Tycos Fever Thermometers
A necessity in every home.

Tycos Stormoguide
Forecasts the weather twenty-four hours ahead with dependable accuracy.

Tycos Hygrometer
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

Tycos—for the Medical Profession

Tycos Sphygmomanometer, Pocket and Office types.
Tycos Urinalysis Glassware.
Tycos Fever Thermometers.
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Instruments

INDICATING · RECORDING · CONTROLLING

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How Battery Chargers Are Tested

Professor Barrett testing a number of battery chargers submitted to the Popular Science Institute of Standards for approval. Notice the highly sensitive recording meters that make it possible to obtain accurate records of the charger performance in thorough, continuous tests

Separating *the* Good *from the* Bad *in* Battery Chargers

By Prof. Sampson K. Barrett

Chief Engineer of battery and battery-charger tests, Popular Science Institute of Standards

WITH the many powerful radio sets now in use, the majority of which operate most satisfactorily on storage batteries, the selection of a good battery charger is an important problem to many.

It is most essential that the batteries be in first class condition if the receiving set is to give reception of the first order. And it requires a battery charger of the best type to keep the batteries in such a condition.

The choice of a battery charger is, therefore, worthy of the same careful consideration as is generally given to the selection of the set itself. The tests that the Popular Science Institute of Standards makes on battery chargers are no whit less exacting and thorough than are made on radio receiving sets.

There are five points for which the Popular Science Institute of Standards tests battery chargers. The first of these is to determine the charging rate. The exact rate for different battery conditions —partly charged, completely charged, etc.—is found. Tapering characteristics are checked.

The next point to be determined is whether the charger requires adjustment and how often this adjustment is required. This is a very important consideration, for the large majority of people who purchase battery chargers are not technically familiar with their construction and will not be able to get complete satisfaction from a charger that requires frequent and complicated adjustment.

The third point for which a charger is tested is general efficiency. If a charger's cost of operation is so high that it offsets the economy of using a charger, it is not approved by the Popular Science Institute of Standards.

It then is determined whether the charger has an indefinite life, or whether there are parts that must be replaced. In the case of the latter, life tests are conducted on the replaceable parts. If the charger is to give satisfactory and economical service, these parts must be reasonably durable and lasting.

Quietness in operation is the fifth and final point for which the Institute tests battery chargers. No charger is approved unless its mechanical and electrical construction is such that it permits reasonably quiet operation.

To make these tests, a battery charger is connected with a supply in the Institute laboratory just as the user would connect it. Manufacturer's directions are followed exactly, thus determining whether these are sufficiently full and explicit.

Meters of high sensitivity then are introduced. The illustration at the top of the page shows quite clearly how these meters are connected. The recording meters make it possible to obtain exact records of the charger performance in continuous tests.

A charger that has passed these tests by the Popular Science Institute is certain to add to, and not detract from, the general efficiency of a radio receiving outfit. Readers of POPULAR SCIENCE MONTHLY who are contemplating the purchase of a battery charger, or any other radio or tool products, can secure a list of tested equipment by addressing the Popular Science Institute, 250 Fourth Avenue, New York, N. Y.

Send for List of Approved Products

Equip your set with
Balkite Radio Power Units
They provide unfailing, uniform current for both circuits

FOR THE "A" CIRCUIT

Balkite *Battery Charger*

This popular battery charger is entirely noiseless and can be used while the radio set is in operation. If your battery should be low you merely turn on the charger and operate the set. Charging rate 2.5 amperes. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles. Also for 25-40 cycles with 1.5 ampere charging rate.

Price $19.50 *West of Rockies,* $20
In Canada, $27.50

Balkite *Trickle Charger*

Can be connected to the usual 6-volt battery and left on permanent (or trickle) charge. Automatically charges the "A" battery and supplies "A" current from the light socket.

With small batteries (4-volt and small 6-volt) can be used as an intermittent charger of the usual type. Or it can be used as a trickle charger if a resistance is inserted to cut the charging rate to the needs of the set.

As an added convenience to trickle charging some owners add a switch which cuts out the charger and turns on Balkite "B" during operation, making both power supplies automatic in operation.

Charging rate .4 to .5 amperes. Size 5¾ x 2¾ x 5 inches. Fits in usual dry cell compartment. Current consumption 1/10¢ per hour. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price $10 *West of Rockies,* $10.50
In Canada, $15

Equip your set with Balkite Radio Power Units. They improve and simplify radio reception. With their use your current supply is unfailing and always exactly what is required for each circuit. They reduce the amount of attention you give your set.

The popular Balkite Battery Charger is entirely noiseless and can be used while the set is in operation.

The Balkite Trickle Charger converts your "A" battery into a permanent "A" power unit that automatically supplies full "A" current at all times from the light socket.

Balkite "B" II is also well known. It was the outstanding development in radio last year. It eliminates "B" batteries and supplies plate current from the light socket. It fits any set.

The new Balkite "B" at $35 is especially designed to serve sets of 6 tubes and less. With such sets it will perform exactly as does Balkite "B" II with sets of larger "B" current requirements.

Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are based on the same principle. All are entirely noiseless in operation. They have no moving parts, no bulbs, and nothing to adjust, break or get out of order. They cannot deteriorate through use or disuse—each is a permanent piece of equipment with nothing to wear out or replace. They require no other attention than the infrequent addition of water. They do not interfere with your set or your neighbor's. Their current consumption is remarkably low. They require no changes or additions to your set. They constitute a complete, trouble-free radio power equipment, one that is economical, unfailing in operation, and eliminates the possibility of run-down batteries.

Manufactured by
FANSTEEL PRODUCTS COMPANY, Inc.
North Chicago, Illinois

FANSTEEL
Balkite
Radio Power Units

FOR THE "B" CIRCUIT

U. S. Patent May 27, 1924

Balkite "B"

Eliminates "B" Batteries. Supplies plate current from the light socket. Operates with either storage battery or dry cell tubes. Keeps "B" circuit always operating at maximum efficiency, for with its use the plate current supply is never low. Requires no changes or additions to your set. No bulbs—nothing to replace. Requires no attention other than adding water twice a year.

A new model, designed to serve sets requiring not more than 20 milliamperes at 90 volts—practically all sets of 5 tubes or less, and most 6 tube sets. Size 8¼ in. long, 8 in. high, 3¾ in. wide. Occupies about same space as 45 volt dry "B" battery. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price $35
In Canada, $47.50

U. S. Patent May 27, 1924

Balkite "B" II

The most outstanding development in Radio last season. Same as the new Balkite "B" but will fit any set including those of 8 tubes or more. Current capacity 40 milliamperes at 90 volts. Size 9 in. high, 6½ in. wide, 7½ in. deep. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price $55
In Canada, $75

The Unipower, manufactured by the Gould Storage Battery Company, is equipped with a special Balkite Radio Power Unit.

BALKITE BATTERY CHARGER · BALKITE TRICKLE CHARGER · BALKITE "B" BALKITE "B" II

ALL BALKITE RADIO POWER UNITS ARE TESTED AND LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS See page 8

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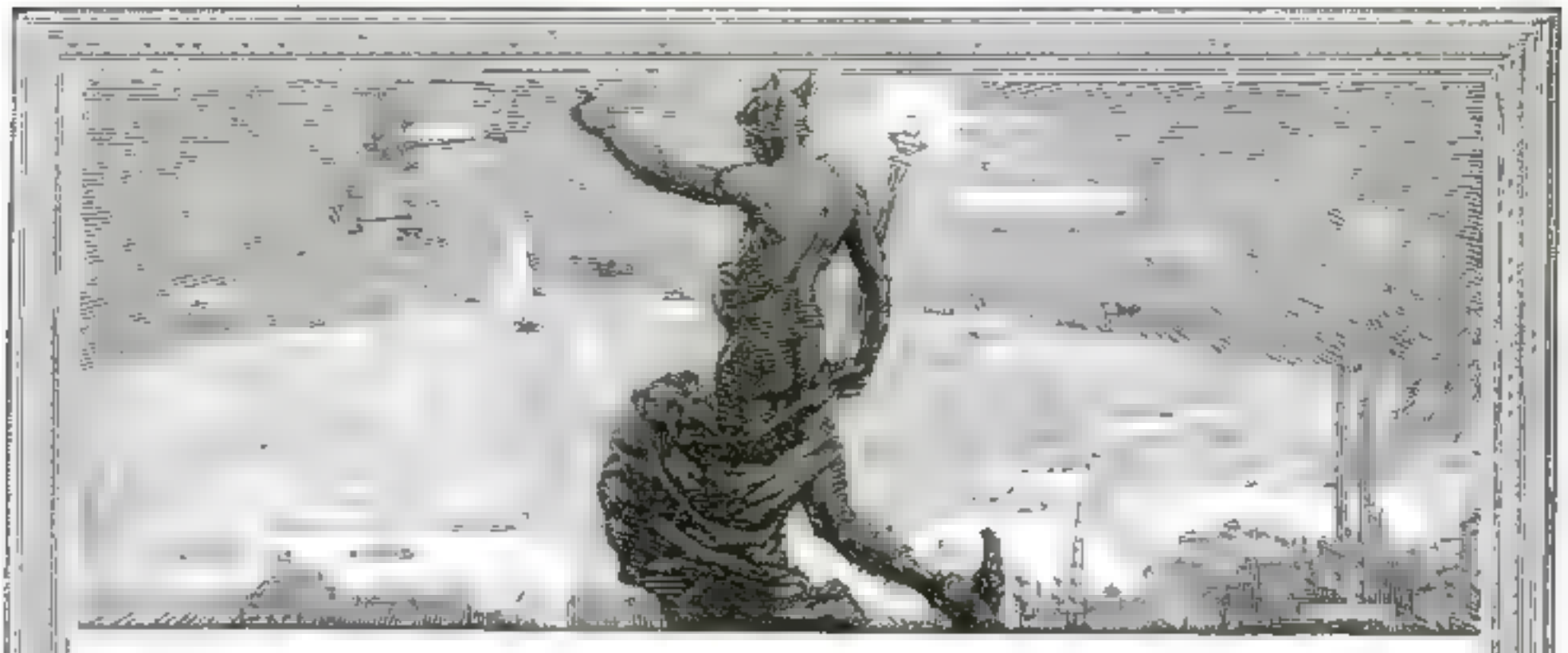


Why Curiosity Pays

ARE you curious? Why? When? Where? In the rear of my country home in New Jersey is a miniature house, built twenty-one years ago. A small, square house with a peaked roof, about fifteen by fifteen. [illegible] birth, except for a new roof. Originally it had a Franklin stove. In the dead of winter, the thermometer below zero, I could poke a few sticks of wood into that stove and in three and a half minutes the house would be hot I would have to open the window.

I built it myself, out of curiosity plus [illegible]

[illegible]e has been quite a traveler. When I moved, I took it with me to my next residence. When I bought my present home, I brought it with me. It has seen the world, has rubbed up against humanity, and has been a shelter for man and beast.

When I die I shall hope to take it with [illegible] N[illegible] sions in the sky. But there might be a delay. Besides, I would want the good angels to know that I built this house myself with my own hands, and that it once saved my life. [illegible] present but the future. All on account of curiosity.

When I built it I was very ill trying to beat [illegible] day and said if I could do some work in the open air, it would help. I had seen log cabins in the mountains. Bungalows then were coming in and I had seen pictures of them.

"I am a little man," I said, "but can I build a house in my back yard?"

[illegible] I never had made anything in my life. Always [illegible] man about the house I [illegible]dered a hopeless mess. Every one conspired against me. They put me in a steamer chair out in the back yard in the sun, tucked me up, and left me to my curiosity.

Could I do it? The answer was no. And could I do it? The answer was yes [illegible] swept me along to victory. From the day that house was finished my [illegible] certain. I had the laugh on them [illegible] is one of the greatest moving forces in the world. Curiosity killed a cat and Bluebeard's wife. It saved my life. To understand it, to control it, to develop it, to turn it on at the right moment, is to be one King Pin among just the few at the top. The ladder of success is built on interrogations. Let me suggest a method.

IDLE curiosity almost always occupies itself with single objects, and is a waste of time. [illegible]s itself with principles [illegible] follow inevitably. My question "Can I build a house?" was answered eventually by the house itself. Result: Health.

In many cases, it takes courage to be curious. [illegible] world. When any problem presents itself—[illegible] question it, be curious about it. The mere [illegible] the road to the true answer.

Here are four sample questions. They can be multiplied indefinitely. It is one of the most interesting and profitable games: Why am I too thin? Why am I too fat? What makes me bashful? What makes me timid?

When we introduce an interrogation point [illegible] trail—it never lets up until the answer is [illegible]

—THOMAS L. MASSON.

FOUNDED 1872

POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, *Editor*

January, 1926

FIFTY-FOURTH YEAR

Shooting a line from a mortar on the deck of the *President Harding* to the sinking freighter *Ignazio Florio*, tossed and battered, at the mercy of mountainous waves. A remarkable photograph taken during the heroic rescue that was effected a few weeks ago, and that was made possible by wireless

Saved!

The Italian freighter a crew of 27 being carried to safety in the liner *President Harding* in a lifeboat manned by hardy volunteers

How an *Invisible Lifeline* Rescues Men from the Sea

A Story of Heroism Made Possible by Wireless

By Peter Vischer

WHEN the Italian freighter *Ignazio Florio* was pitched and tossed a few weeks ago in the mountainous waves and cavernous depths of the worst storm an angry Atlantic has concocted in many years, it was an invisible lifeline that held out hope to her badly battered crew. That line was composed of the dots and dashes of Morse code sent by wireless.

A tempest in mid-Atlantic would well be a match for the iron boxes that sail the seas but for that invisible lifeline. Gales that sweep like cyclones, waves that coil and strike like giant sledges, swirling waters that hiss ominously and churn and churn, still taunt and harrass seamen—much as they ever did.

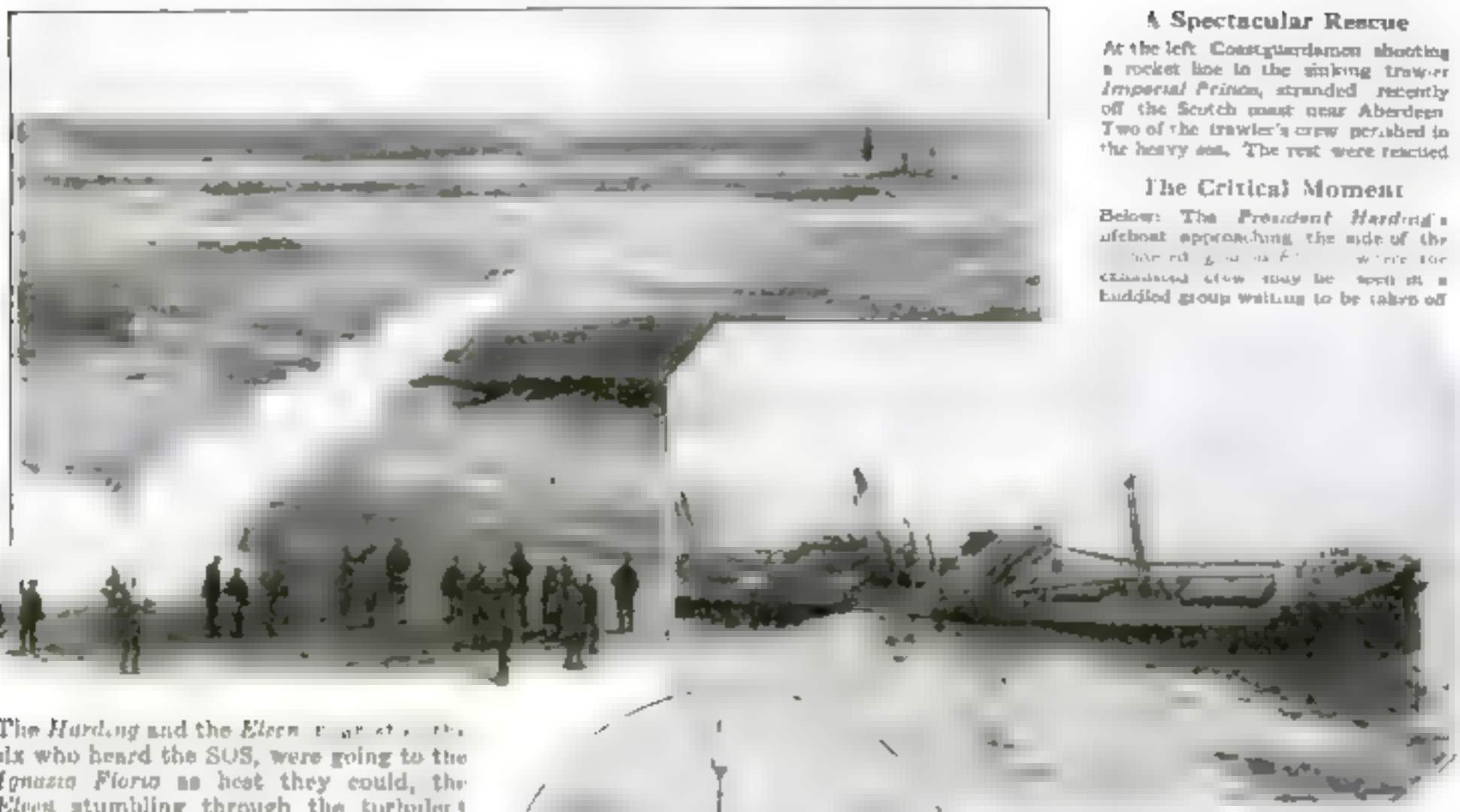
Ships still are swallowed by a hungry ocean. Even now restless waters are licking the iron bones of the Italian freighter. But, thanks to radio, and to the traditional courage and humanity of one seaman called to the aid of another, those bones are dry of their marrow of men. Twenty-seven men and a cat were saved from the canted deck of the *Ignazio Florio* by Capt. Paul C. Grening, of the United States liner *President Harding*. Only one man and a dog were lost, the one an officer swept from his bridge by a thunderous wave before the *President Harding* was called to rescue; the other, smashed against the side of the freighter as he tried to swim to his rescuers.

Thus is the ingenuity of man, as expressed in progressing science, succeeding in his struggles against what were once considered insuperable natural odds, acts of a displeased god. Thus is man inventing new life insurance for himself. But for the helping hand of science, storms would have taken a lamentable toll of life during the week the hapless *Ignazio Florio* foundered.

George Kohle, radio officer of the *President Harding*, was sitting in his cabin one night, phones on his ears, cigarette alight. All at once he straightened up. His hands went to the phones and he listened sharply. A switch clicked home and generators began to whine. He had the *Florio's* SOS. Possibly you heard it on your own radio set. Certainly, if you live in the eastern part of the United States, broadcasting suddenly was stopped for you when the call of distress sounded.

KOHLE grabbed the speaking tube and shouted to his captain, who was gazing outward from a tossing bridge. He broadcast the SOS and got five answers out of infinity—from the *Lorain*, *Elsen*, *Portland Maru*, *Invergoil*, and *Cadore*. Even then the *Harding* had changed her course, plunging directly into the vortex of the storm to go to the Italian's assistance.

Back and forth went messages of hope, pleas for quick help, promises of assistance, requests for directions and bearings, orders for lights and rockets.



A Spectacular Rescue

At the left Coastguardsmen shooting a rocket line to the sinking trawler *Imperial Prince*, stranded recently off the Scotch coast near Aberdeen. Two of the trawler's crew perished in the heavy sea. The rest were rescued

The Critical Moment

Below: The *President Harding*'s lifeboat approaching the side of the [illegible] where the exhausted crew may be seen in a huddled group waiting to be taken off

Through the Storm on a Raft

Lashing themselves to a small improvised raft these six sailors of the wrecked schooner *Hatteras* recently rode safely through a six hour hurricane and drifted for five days without food or water. When finally picked up by the liner *Southern Cross*, all were on the verge of collapse. One of the survivors is holding a pole with handkerchief attached with which they attracted attention of the liner. The *Hatteras* went down in a seething sea off Cape Hatteras, on the coast of North Carolina

The *Harding* and the *Elcon* [illegible] six who heard the SOS, were going to the *Ignazio Florio* as best they could, the *Elcon* stumbling through the turbulent waters at two knots; the *Harding* managing to make six.

Even then the Italian freighter was doomed. A mountainous wave had smashed in a forward hatch and water was flowing into her bowels. Water was flowing to a thirsty cargo, a cargo of grain. The rudder was broken. One of the booms was off. The lifeboats were smashed.

"THAT Captain Grening, he is very great human ity," said Capt. Angelo Lauro, master of the freighter, when he arrived in New York, "for we were in very bad way. We were in very terrible weather with a very terrible cargo. Grain, grain is no very bad. When you ship water you had better have wild horses on board than grain. Grain drinks and drinks—and then—"

Yes, the freighter was doomed. But her men were not. For 50 hours Angelo Trombino sloshed about in an engine room that was a death trap, administering to dynamos and pumps. For the same 50 hours Luigi D'Ambrogi sat in a wireless shack and tapped. And listened. While these two, trained in the uses of science, carried on, there was yet hope.

Finally, after a night and a day of buffeting, the *President Harding* sighted the freighter. She reeled 'round and 'round the foundering box. The seas fought to keep them apart; but slowly, slowly, the *President Harding* drew close.

The next afternoon Captain Grening got out the Lyle gun—a mortar from which a projectile with an attached line is shot. The *Harding* was to windward and oil was poured on the waters to lay the waves. The gun was fired once, twice, thrice, before the line went to the freighter. A lifeboat was floated on the line, but there was no getting into such a comet. Hemp lines were sent over, but they parted. Only the radio line was flexible enough to hold.

At intervals through the night, Captain Grening played his searchlight on the unhappy freighter and realized the craft was nearing her end. He made up his mind that the moment she started down he would drive for her, run his ship bow to her bow, and drop overboard anything that would float—rafts, life preservers, planks. He meant to save lives if it were humanly possible.

SUCH a desperate effort was saved by a curious lull in the storm, a softening in the waves for two hours of the early morning, during which Captain Grening sent over a big Lundy lifeboat manned by volunteers. Every man on the *Harding* wanted to go. And then Captain Grening made this entry in his log:

"Detention 21 hr. 15 min., rescuing crew of S. S. *Ignazio Florio*. Overcast, whole gale, very high sea."

It is within the very recent memory of man that the wireless was first used at sea. The first message was sent from the American liner *St. Paul* to the *Needles* on Nov. 15, 1899, as the former was completing her fifty-second voyage across the Atlantic.

To laymen, the success of wireless [illegible]graphy on the high seas was only assured in 1909, when Jack Binns sent out a call for assistance from the White Star liner *Republic* after her collision with the Italian Lloyds steamship *Florida* off Nantucket. That happened Janu[illegible] 1909.

The *Republic* had on board 700 pleasure-seeking Americans bound for a [illegible] when she collided with the [illegible] 900 emigrants and a crew of 200. From the wreckage of a Marconi room, Binns, cold and drenched and hungry, kept sending out what was then the call of a crippled boat for help:

"C Q D, C Q D, C Q D."

THE quick response to that call was all that saved hundreds of lives.

Two months after the *Republic* collision, the steamer *Horatio Hall* was aided in distress in almost the same position. Four other times that same year wireless summoned aid to foundered ships, among them the steamer *Ohio*, from which 150 passengers were rescued off the Alaskan coast. Not a month—hardly a week—has passed since then without some incident of the same kind.

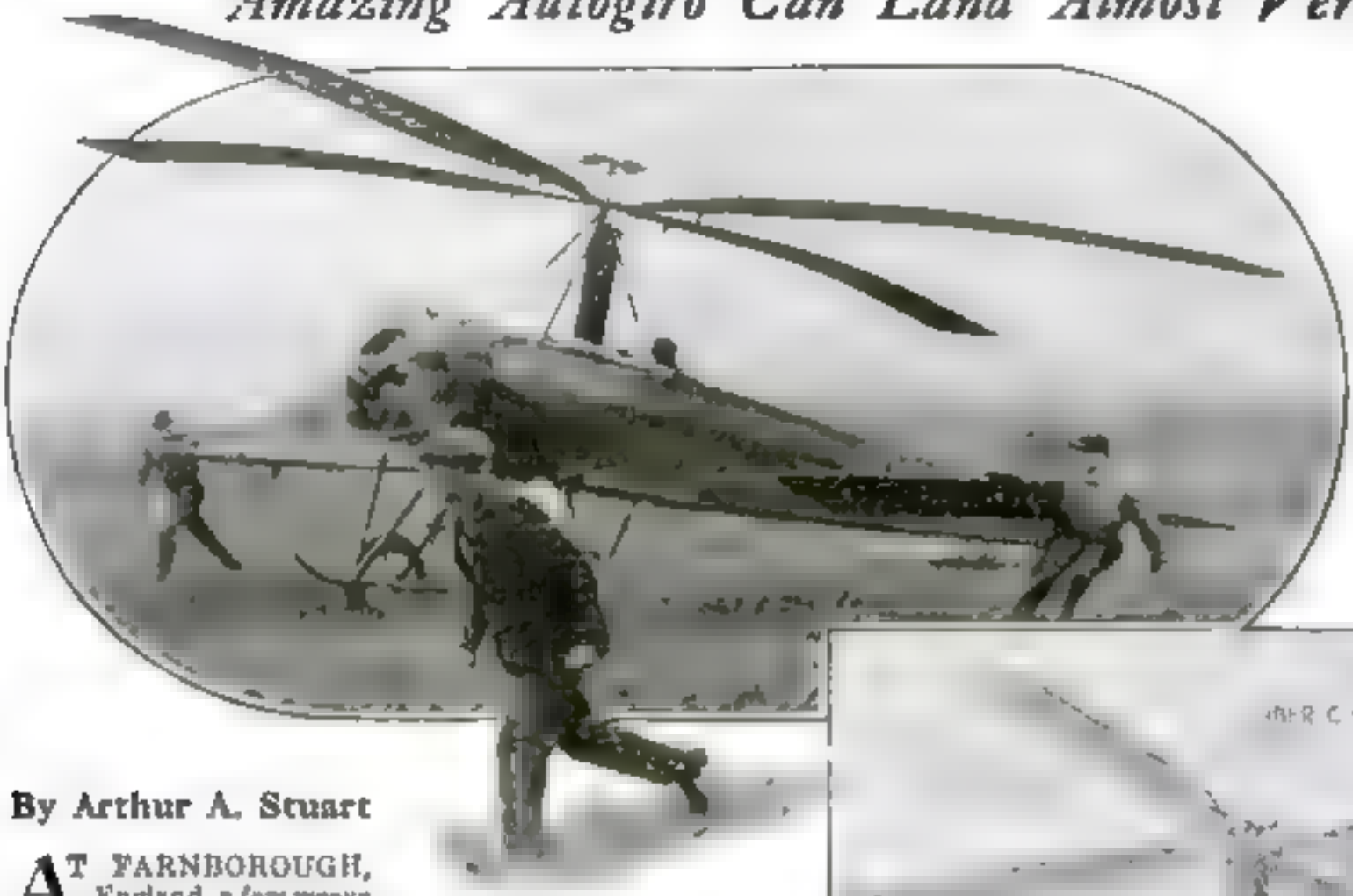
Without wireless, the *Titanic*, which struck an iceberg on her maiden voyage and sank in mid-Atlantic with enormous loss of life, would have dropped from sight to become one of the world's many maritime mysteries.

More than a thousand American seamen have gone to watery graves in a score of vessels that have disappeared from the face of the earth without a trace. Some of these, curiously, disappeared during this present century, in spite of the safety to be found in modern means of communication.

These, however, are the exceptions that prove the rule that today we know. The developments of science have made it possible for the seas to be made as safe as land; and, if you'll believe many an old salt, much safer.

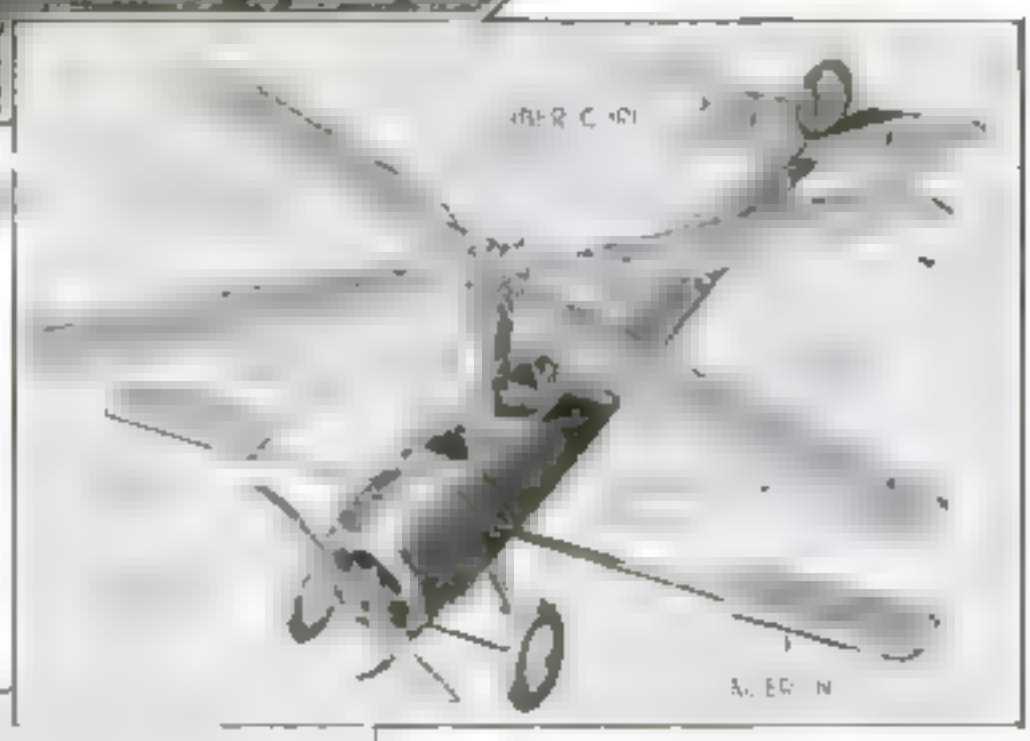
Flaps Its Wings like a Bird

Amazing Autogiro Can Land Almost Vertically



The Successful Test Flight

Left: The autogiro, piloted by Capt Frank Courtney taking off for its successful test flight at Farnborough, England. By means of its flapping windmill like wings it rose swiftly flew nearly 50 miles, then returning to its starting place, dropped almost vertically Below Diagram showing constructional details of the remarkable machine. Note the huge lifting screw driven by the wind and turning at from 120 to 140 revolutions a minute



By Arthur A. Stuart

AT FARNBOROUGH, England, a few weeks ago, a group of aeronautical engineers and aviation enthusiasts assembled to witness an event that may revolutionize completely the future development of the art of aviation. An odd, awkward looking flying machine, topped with a windmill arrangement that flapped like the wings of a bird, rose swiftly from the ground, accomplished a trial flight of almost 50 miles, and then returned to its starting place, dropping almost vertically and coming to a full stop within 20 feet of the place where it first touched the ground.

This queer machine, which conforms to none of the usual rules for airplane design, is called the "autogiro." It is the invention of Don Juan de la Cierva, a young Spanish engineer, who has brought it to its present stage of development after five years' work

Vice Marshal Sir Sefton Brancker, of the British Air Force, after witnessing the successful demonstration of the machine, declared that "it is the greatest step in aeronautical progress since the Wright brothers flew the first airplane."

That de la Cierva was working on a revolutionary type of aircraft has been no secret. Several articles describing various stages of his progress have appeared in POPULAR SCIENCE MONTHLY. The aviation world, however, scarcely was prepared for the sensational success of this public demonstration.

WHEN Capt. Frank Courtney climbed into the fuselage, the tractor air screw was set whirling, the huge blades flapped, and within 300 feet—about one-third the distance required by the ordinary airplane—it had left the ground and was sailing gradually out of sight. Then at the end of the trip came the most remarkable part of the demonstration.

When only a few hundred feet above the ground the pilot shut off his engine. The tractor screw slowed up and ceased to revolve, and the machine floated down almost vertically, landing without damage with a run of less than 20 feet. Here, at last, was an airplane that could land on a mere spot; the airplane possibly that may point the way to planes that can land on the roofs of houses or in city streets and parks and thus enlarge amazingly the utility and scope of aircraft.

Hovering, with Engine Dead

Nearing the ground the pilot shut off his engine and the machine floated down almost vertically, landing with a run of 20 feet

The machine starts off in the ordinary way by aid of an engine-driven tractor screw. To start the lifting blades rotating, men haul away a steel cable wound round the base of the screw, much as a string is pulled from a top. According to measurements, the autogiro leaves the ground with the low speed of 15 miles an hour. Its maximum speed in the air is 70 miles an hour

IN ORDER to stay in the air, an ordinary airplane must keep up high velocity. Even a small loss in velocity may result in an accident. It is claimed that the autogiro is very slightly affected by loss of forward speed, the real speed which counts for sustentation being that of the wing tips, which travel over a spiral path at a much higher velocity than the speed of travel.

Even if the engine should fail completely, the blades of the autogiro will sustain the plane in the air, allowing it to sink slowly and land safely

Inventions that Edison Still Hopes to Make

Nearly 80, he now works only 18 hours a day because he has to sleep more—But even so, he may give us an automobile battery to last 10 years, and other marvels to make life pleasanter—His remarkable forecasts of future progress—A fascinating, intimate picture of America's grand old man of applied science

By John R. McMahon

EDISON in his seventy-ninth year is running short of time—has to sleep so much now that his working day is limited to a pitiful 16 or 18 hours. He needs every moment of that short day for his important activities. That's why he has practically quit giving interviews and why he felt that he was doing a considerable favor recently when he talked to me awhile for POPULAR SCIENCE MONTHLY

I used to interview America's grand old man of applied science when three or four hours of nightly sleep gave him a bit of leisure. He was then crusading, as it were, against humanity's vicious sleep habit. He almost had us converted when Nature put the brakes on his very self He admits that Nature has licked him into wasteful snoozing. You cannot say that he has the sleeping sickness, yet his daily working time is now only about twice that of the average man. He works only two days in one, instead of almost three, as when he was in his prime.

IMPORTANT as Edison's work is, you feel the man is more important. Might be better if he were made to knock off all work for the rest of his life and just talked to the American people on how to do it. This father of half the marvels of civilization should just scold us and cheer us and advise us what to eat for breakfast.

You go away from his Orange, N. J., laboratory in a daze, feeling that you have talked with Moses, Columbus, and Darwin in one. He is the most historical character in the world today. Legends are forming about him. A barrel of haloes are ready to put on his brow I am glad there is also plenty of homely stuff, some of which I'll give you, about Tom Edison, the pal and crony of his men in the experimental shop.

Every one knows what he looks like at least that domelike forehead, now thatched as Pike's Peak in winter. Ruddy complexion, gray eyes that often stare and dream. A chunky middle-height figure, careless of dress, who trots about spryly, hatless most of the time. A high pitched voice that may drone or become a bit nasal. One of the most human of men—boyish, slangy in offhand talk, and, like most great men, always unconscious of self

After patenting more than 1000 inventions, of which several are major contributions to human progress, has Edison another miracle or two up his sleeve? I asked him that and you'll see he dodged the answer. My bet is in the affirmative. Assume such a man and such a record, still able to work two days in one, he can't help adding another ornament or so to the monument of his achievement And that ornament will be our gain—yours and mine—the whole world's.

It is said a traveler asked an Eskimo and then a South Sea Islander who was President of the United States. Both replied "Edison." When the same question was put to the king of an African tribe, his majesty hesitated between Edison of the talking box and a comedian of the pictures that move. A discarded incandescent bulb was put on a heathen altar by a native priest and maybe it helped to illuminate the mind of the tribal god.

"Which of your inventions are your favorites?" was the first question I put to Edison.

"Phonograph, moving pictures," he replied. One may note his economy of language in leaving out "and"

THE answer reminds us of a fact of which many are unaware, that the inventor did pioneer work in moving pictures. This was during a period from 1887 onward to the late 90's, when the world did not dream that pictures could follow action

"Why do you prefer the phonograph and the pictures, Mr Edison?"

"I like the phonograph because I love music, and there are great possibilities. The motion pictures are my only theatrical diversion on account of my extreme deafness"

The inventor of the phonograph not only loves music but selects the artists and the compositions for the records of his machine. He used to have a flock of prima donnas in his laboratory, trilling and warbling under his personal direction. Seems to me like the high C of versatility for the same man to invent, manufacture, and then act as bandmaster for his recording songbirds. As for his "extreme deafness," that is a small and casual handicap; he has been more or less deaf for many years. Beethoven was deaf most of his life.

EDISON says—

"THERE is no limit to the invention of fully automatic machines. Man will work less and less."

"The sun engine will come when the price of combustibles greatly increases."

"It is possible to make a concrete house in a few hours."

"The world doesn't need more inventions just now, until general intelligence has increased so men can be had to operate what we have."

"What new lines of research am I engaged in? Many. Wait until I've caught the fish."

"My favorite inventions—phonograph, moving pictures. I like the phonograph because I love music. The motion pictures are my only theatrical diversion on account of my extreme deafness"

"I now sleep from five to six hours. The quality is still perfect."

"I eat very little. The amount of power one can get out of a piece of toast is marvelous."

"The number of men in every nation, per capita, who are honest, humane, and intelligent is increasing. This number is a measure of our civilization. The Lord appears to be in no hurry."

"One of the Most Human of Men" Thomas A. Edison as He Is Today

A chunky, middle-height figure, careless of dress, who trots about spryly, hatless most of the time. A domelike forehead, now thatched as Pike's Peak in winter, ruddy complexion, gray eyes that often stare and dream. A high pitched voice that may drone or become a bit nasal. Boyish, slangy in offhand talk, always unconscious of self. That is the great Edison at 79

"What about that sun engine?" I asked, referring to his old project of getting energy direct from the sun's rays. He had a model, I believe, to which Sol contributed a fraction of the potential billions of horsepower

"It will come when the price of combustibles greatly increases"

A humorist may comment that, thanks to the coal strike, the sun engine is now due. Without question, such a machine is practicable in desert or cloudless areas. Something of the sort has been reported in use in Egypt. Last summer an egg was cooked by sun heat on a Washington pavement, according to report. Let's laugh now; posterity will laugh at us.

"And your poured house, Mr. Edison?" I asked. "Isn't this now practical commercially by use of the new bauxite cement that hardens in 24 hours?"

"It is possible to pour a house in a few hours," was the reply. "The commercial man of vision has not yet come forward. Portland cement is all right, as it can be made 'quick set.'"

It may be explained that for this scheme the inventor has set up the mold of a complete home in cast iron plates, smoothly machined and bolted together There was reinforcement within the mold Liquid concrete was to be poured in at the top, making the house in one operation. At the time of the house project, Edison told me it was his pet; he hoped it would be his special gift to working people who wanted a substantial home, he was not going to accept a penny for that invention. Let's take the will for the deed, and hope that "the commercial man of vision" will yet get busy on this housing stunt. In the laboratory yard I saw a sample of house ornament in cement that has been weathering for years and looks like new.

"Has the alkaline storage battery been further perfected?"

(Continued on page 112)

Lessons in Magic—*By* Houdini

In Houdini's Laboratory

The photograph at the right shows Houdini and his assistants in the magician's New Jersey laboratory making the complicated and expensive apparatus used in his stage work. Effective magic tricks, however, can be performed with no special apparatus, as Houdini demonstrates in the accompanying article. One of these, a torn paper trick, is explained on page [illegible]. Houdini is performing in the picture just below

The King of Magicians Explains Simple, Mystifying Tricks that Any Amateur Can Perform at Home

IN THE course of my discussion of the tricks of fraudulent spiritualistic mediums in the last two numbers of POPULAR SCIENCE MONTHLY, I mentioned several times the legitimate trickery that professional magicians use to entertain and amuse. In this article I am going to tell you something definite about that kind of trickery. In fact, I am going to give you a lesson in magic—teach you how to do some most effective tricks with which you can mystify your friends.

The tricks I have selected are simple and require no apparatus beyond common objects that you will find at hand almost anywhere. You can learn the *method* of performing any one of them in a few minutes, and, even if you never have previously attempted to be an amateur magician, you ought to be able to acquire the dexterity necessary to perform them perfectly by a little practice. Simple though they be, however, they are real professional tricks that I myself use or have used on the stage, or that have been used by some of the most famous conjurers that the world has known

Possibly as good a way as any of illustrating how a trick most simple in detail can mystify and bewilder even an exceptionally intelligent and wide-awake audience, is to describe a trick that I performed not long ago at an entertainment given by a secret order in a hall in the upper part of New York City.

I borrowed three handkerchiefs from the audience, had them marked for identification, knotted them together, and placed them under an opaque glass bell on a table. Then I informed the audience that I would undertake to transport the handkerchiefs magically from beneath the bell to any place that might be selected within 16 miles of the stage. The place was to be chosen by vote, so I distributed slips of paper on which the members of the audience might write their wishes. The slips were collected, placed in a hat and brought to me on the stage. I dumped the votes on a plate, picked up three of them and had a little girl select one of these. When this was unfolded by a gentleman from the audience, he read.

"UNDER the top step of the Statue of Liberty."

Immediately a titter went through the audience. The Statue of Liberty, as you probably know, stands on a little island in New York Harbor, 10 or a dozen miles away from the hall in which I was performing. That I should claim that by waving my wand I could cause those three handkerchiefs to be wafted invisibly over the city and bay and to be carried up the narrow winding stairway in the interior of the statue seemed highly ridiculous

I acknowledged the laughter; then I requested the audience to select a committee of men unknown to me and of such character and standing that they could not be bribed or otherwise persuaded to aid me in deception. With this committee I left the hall, rode in the Subway to the Battery, and took the steamboat to Bedloe's Island, where the statue stands. The committee mounted the stairway and under the top step found a locked metal box. With this we returned to the hall, where the persons attending the entertainment were by that time sitting at a banquet.

IT WAS necessary to call in a locksmith to open the box, and inside it was found another box of tin, sealed with solder. When the second box was opened there were the three handkerchiefs!

Now you may suspect that I myself carried the handkerchiefs to the statue, hiding them from the committee which accompanied me and placing them in the boxes by some feat of conjuring. I assure you, though, that I never touched the handkerchiefs from the time the audience saw me with them on the stage until the locksmith opened the boxes in the banquet hall. This is the way the trick was done:

Under my waistcoat I had three other

handkerchiefs, knotted together just as I knotted the handkerchiefs obtained from the audience. I made a "switch," taking the prepared handkerchiefs from beneath my vest and substituting the handkerchiefs I had borrowed. Then I placed my own handkerchiefs under the glass bell. In doing so, I contrived to drop the bell to the stage and break it—a piece of pretended carelessness which I had previously rehearsed.

ACTING as though chagrined by the "accident," I called to my assistant to hand me another glass cover, and, as I met him at the wings to take it from him, he deftly took the handkerchiefs from beneath my waistcoat, hurried out of the hall, took the subway to the Battery and caught the boat for Bedloe's Island. On the island, another assistant and a tinsmith were waiting for him. The boxes were hastily prepared and placed on the statue stairs, where they were waiting for the committee.

The Statue of Liberty boats operate on a definite schedule, so it was easy for me to time the performance of the trick so that my assistant would catch one boat and the committee and I a later one, giving my confederates ample time in which to box the handkerchiefs.

The choice of the statue, of course, was made by me and not by the audience. Concealed in my hand, I had three slips of paper on each of which I previously had written a "vote" for this place. When I dumped the votes of the audience from the hat, I placed these three slips on top of the pile, then picked them up again and offered them to the little girl.

This is a trick that is quite within the capabilities of an amateur performer. In these days of motor cars, you might even permit your audience actually to choose the place to which the handkerchiefs are to be transported; then, when the choice is announced, have your confederate dash off in a car and leave the handkerchiefs at the spot designated.

HERE is a trick, not so complicated though probably more difficult in that it requires not a little dexterity, skill, and "patter," or small talk, to "put it across" properly. It is a trick that many famed magicians have used successfully. You tear up a cigarette paper, roll it into a small ball, then open the ball and show the paper untorn and undamaged except for a few wrinkles.

As a preparation for the trick, roll a cigarette paper into the smallest ball you can and conceal it in the fold of skin between the thumb and first finger of the right hand. I have indicated the position of the pellet in the accompanying photograph, although the thumb and forefinger, of course, must be held closer together for purposes of concealment when you are actually performing the trick. Then take a cigarette paper and tear it into four or five strips. Roll these strips between the finger tips into a little ball. Work this down between the palms and continue rolling as though desiring to compress the paper still further.

This will give you an opportunity to remove the prepared ball from between the thumb and forefinger to the palm of the right hand, while you slip the torn ball into the fold between the thumb and forefinger of the left hand or between the tips of the thumb and forefinger of the right hand where it will be concealed by the untorn paper. A little practice will enable you to do this swiftly and invisibly to your audience.

Take your prepared ball and slowly unroll it. When it is smoothed out as much as possible, let it flutter to the floor. The eyes of your audience will be drawn irresistibly to the falling paper, and this will give you an opportunity to get rid of the ball of strips by some natural movement that will not be detected.

THERE are several other ways of performing this trick. The method I have given though, is possibly the simplest, and hence the one best suited to a person who is not an experienced magician.

Here is a simple trick that is bound to provoke amazement and wonder: You take a piece of paper, half a sheet of newspaper, say, roll it into a ball in front of your face, then take your hands away—and the ball remains suspended in the air! Not only that, but it will obey your commands to rise or fall!

The secret of this trick lies in having a long hair suspended from your ear or temple with magician's wax. There is also a tiny bit of wax at the other end of the hair. You affix this latter piece of wax to the wall or to the side of a bookcase or some other article of furniture, a thing you can do easily without arousing suspicion. Then you roll up the paper around the hair, and, when you take away your hands, it remains apparently floating in the air. By moving your head slightly forward or backward, you can cause the ball to go up or down at your order.

A simple trick that can be performed successfully virtually without practice, yet one that will mystify almost any audience, is known to magicians as the "One-Ahead Envelope Trick."

You distribute envelopes and sheets of paper among your audience, requesting each person to write a question on the paper and seal it in the envelope. Then you collect the envelopes, hold them one by one against your forehead and read and answer each question apparently without opening the envelopes.

THE simplest way of performing this trick is with the aid of a confederate in your audience. When you have collected the envelopes, pick up the top one, hold it to your forehead, and, after appearing to concentrate for a moment, ask any question that hap-

Houdini Shows How a Perfect "Spirit Glove" Can Be Made

SPIRITUALISTS say only a disembodied spirit can make a paraffin hand; that a human hand cannot be withdrawn from a mold of paraffin because the wrist is so much smaller than the wide part of the hand. Houdini shows here how a perfect "glove" of paraffin can be made. The hand is greased, then alternately dipped into the cold water in the jar at the center and molten paraffin in the can at the right, until the desired thickness of paraffin is obtained. With the index finger the edge around the wrist is gradually loosened, and the hand is thrust into the water to permit the water to trickle between the hand and the paraffin. Then the hand is thrust into the can of warm water at the right. This softens the paraffin sufficiently to permit the withdrawal of the hand. With the paraffin kept soft with warm water the wrist of the glove is manipulated to the correct size and shape. Molds of hands in virtually any position can be made by this method—even two hands clasped. This is Houdini's first exposé of this spiritualistic trick which is interesting not only to investigators of psychic phenomena, but also to sculptors and others who might find use for a method of making perfect reproductions of the human hand

pens to pop into your mind. Your confederate will acknowledge this question as his. You answer it; then you open the envelope, as though to check the accuracy of your reading, and read the question written on the sheet you find within.

Holding a second envelope to your forehead, you repeat aloud the question that was contained in the first envelope. The person who wrote it, of course, will acknowledge it; you give your answer, and, under pretext of satisfying yourself as to the correctness of this reading, you open the envelope as before, thereby learning what the next question is. You proceed in this way until you have answered all the questions. It will be necessary for you, of course, to reach the envelope containing your confederate's question last of all.

YOU can also perform this trick without a confederate. When the envelopes have been collected, pick one up at random, hold it to your forehead, and, pretending to read the contents, say, "Why does Lillian love me?" or something equally unlikely to be acknowledged by its supposed writer.

When you get no response, pretend to be displeased, and say, "Well, if you won't acknowledge your questions, I can't very well proceed with the test. I'll try one more, though." Then open the envelope and repeat its contents as you hold the next envelope to your forehead. In this case it will be necessary for you to have in the pile one envelope more than the number actually collected from your audience. Otherwise you're likely to be embarrassed by finding that you've answered all but one of the questions and have no envelope with which to proceed with the trick.

There are many other versions of this trick. The key lies in discovering the contents of the first envelope. Your own ingenuity may suggest other methods than those I've mentioned. As a hint: Alcohol will make even the best grade of paper almost as transparent as glass, and it evaporates so rapidly that its use is not likely to be detected by ordinary audiences.

HERE'S another simple but "showy" and effective trick. Take four or five packages of paper clippings, each of a different color, say red, green, yellow, blue, and white. Open them and place them in a glass bowl or jar that is large enough to receive your entire hand. Ask some one in your audience to mix the paper thoroughly. Then when the different colors are mingled virtually beyond hope of separation, ask the mixer to plunge his hand into the jar and draw out a handful of blue paper only. He will hesitate and look at you in bewilderment.

"What!" you say to him. "You can't do it? Here, let me show you." Then thrust your hand into the bowl and draw out a handful of the color you have mentioned.

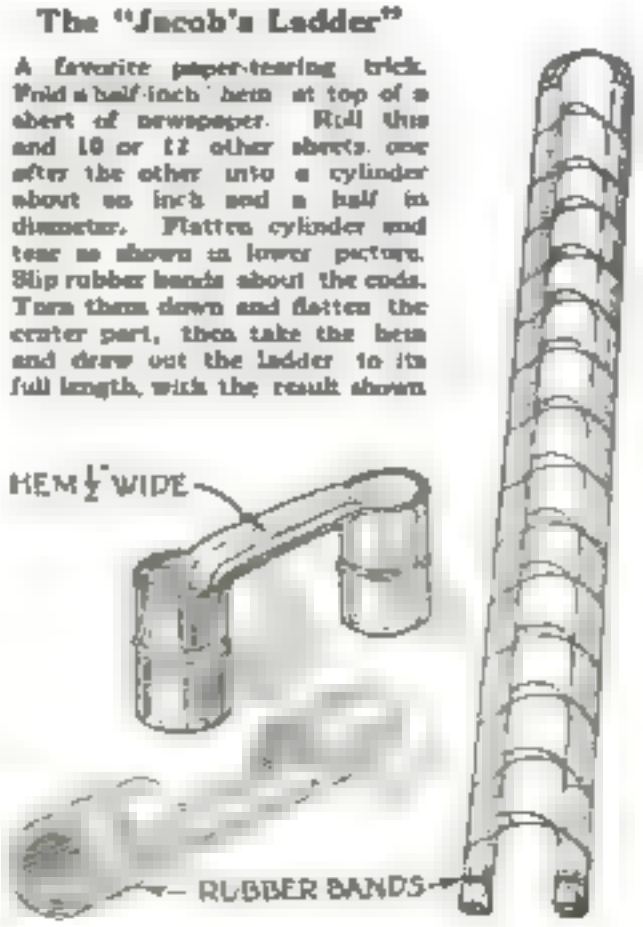
Then say, "Well, now that I've shown you how it's done, you ought to be able to take out a handful of red. What, you can't? Look!" And proceed to plunge your hand into the jar again, this time drawing out red paper only. Repeat the test until you have demonstrated conclusively your ability to draw out any of the five colors at will.

The trick in this case lies in having little packages of paper of each color hidden under your vest, or in little pockets sewn to your trousers. Each package is secured by a strip of tissue paper of the same color as the paper it binds. When a certain color is called for, get hold of the proper package, place your hand in the bowl, and, with your movements screened by the paper in the bowl, work your fingers until you've broken the tissue paper seal. Then take out your hand, and, moving your fingers so as to separate and crush the bits of paper, let the clippings flutter down.

I have found that simple tricks performed with household utensils and similar objects are much more effective for an impromptu display of magic than are more complicated illusions, requiring apparatus that the performer "just happened to bring along." Even if your apparatus is nothing more than an ordinary pack of cards, the fact that it is yours will arouse the suspicions of your audience, whereas you can "get away with murder," as the saying is, in performing tricks with articles that you pick up apparently at random.

The Cigarette Paper Tear

This highly mystifying trick consists of tearing a cigarette paper into strips rolling it into a little ball, and then unfolding it to show it uninjured. The secret lies in having another paper rolled into a pellet and concealed at the root of the thumb as shown in the larger picture. When the other paper is torn it is rolled into a ball and hidden between the tips of the thumb and forefinger as shown in the upper picture while the prepared paper is unrolled. The audience of course is not aware that two pieces of paper are used



The "Jacob's Ladder"

A favorite paper-tearing trick. Fold a half-inch hem at top of a sheet of newspaper. Roll this and 10 or 12 other sheets, one after the other into a cylinder about an inch and a half in diameter. Flatten cylinder and tear as shown in lower picture. Slip rubber bands about the ends. Turn them down and flatten the center part, then take the hems and draw out the ladder to its full length, with the result shown

A GOOD example of such a trick can be performed with a table knife and six bits of paper. The pieces of paper, which are carefully torn so as to be exactly the same size and shape, you moisten and affix to the knife blade, three on a side, those on one side corresponding in position exactly with those on the other. Explain to your audience that each little piece of paper is so fond of the corresponding piece on the opposite side of the blade that, if you were to remove one, the other would go away.

Illustrating this, you remove one piece, roll it into a little ball and throw it away. And, sure enough, when you show both sides of the knife, each contains only two pieces. Removing another, you show there is now only one on a side, and, when you take away the last one, both sides of the blade are found to be empty.

Pause a moment. Then look at the knife in surprise, and say, "Hello! I just heard three little taps. Sounds as if some of the papers were back!" You raise the knife, turn it about, and there are three papers on one side and none on the other. You hold the side containing the papers uppermost.

"Well," you say, "if those three are back, their partners will soon be here. Ah, here they are!" And you turn the knife over, showing three papers on each side as at the beginning.

TURN the knife over several times, then stop as if listening for a moment, and say, "Well, those three that just came back have decided not to stay with us after all. There they go." And, when you turn the knife about again, one side is found to contain three papers, while the other is empty. Pass the knife around, and let your audience see that three papers only are on the blade.

The secret of this trick is a simple sleight of hand through which you show the audience only one side of the knife while making them believe they are seeing both.

The knife is held close to the table at which you are sitting, with the point away from your body. The upper end of the handle rests on the middle joint of the forefinger, with the thumb on top. In this position only one side of the blade is visible. To show the other, raise the point of the knife to your chin.

Continued on page 140.

Is This the Face *of* Future Man?

Our Descendants Will Have Cramped Brains, Pinched Cheeks, Long Noses, Squinty Eyes, Says Noted Evolutionist

By Ernest Brennecke, Jr.

WILL the faces of our descendants—of our grandchildren's grandchildren—look anything like the rather queer illustration on this page?

Will men of the future have small, cramped brains; sparse hair; long, thin, and prominent noses, tiny, "precious" mouths; narrow, squinty eyes; and no jaws or cheek bones to speak of? Will they, in brief, resemble water-blooded, "esthetic," meagerly nourished morons?

The answer is an unqualified, disheartening affirmative, according to at least one competent authority; and we must pull ourselves together to see just how such startling and undoubtedly distasteful forecasts possibly can be sustained. Already, evidently, our facial architecture is beginning to depart from the powerful, virile characteristics of our hardy ancestors, and to assume the lackadaisical features of this "future face" of ours.

How so? Let us see:

Scientists since Darwin have agreed pretty generally that man has arrived at his present physical stage through a long process of development from lower and perhaps less perfect forms of life. But if evolution has thus been going on all through the past and up to the present moment, will it not continue into the future?

IF SO, then surely it is legitimate to inquire as to the direction in which we human beings will develop and how rapidly we will do so. In particular, if we compare our present features with those of the Java ape-man of some 500,000 years ago, or even the mummified skull of Rameses II of ancient Egypt, and if we notice how much the face of, say, the present Prince of Wales differs from these—then indeed we may well ask what the physiognomy of our successors on this planet will look like a few thousand years from now.

A sober and logical, if unpleasant visualization of our future face recently was proposed by the noted British biologist, Sir Arthur Keith, Fellow of the Royal Society, in an important discourse that he delivered before the Royal Institution on "The Rate of Man's Evolution."

Before arriving at his sensational estimates, Sir Arthur had examined and made records of hundreds of buried skulls of all ages (from the fragments supposed to date back to 500,000 B.C. to the present day), and also had measured carefully the heads and features of thousands of living persons.

His general conclusion: "*Evolution even now is rapidly at work on our faces,*" may be tabulated in detail as follows.

1. Man's brain capacity is growing steadily smaller. ("From the limited data at our disposal we must infer that the people who occupied western Europe at the close of the Ice Age [10,000 B.C.] stood distinctly above their successors of today in the matter of brain size. So far as concerns brain capacity of the skull there has been no increase.")

2. The roof of our civilized human mouth is becoming reduced in size and narrower.

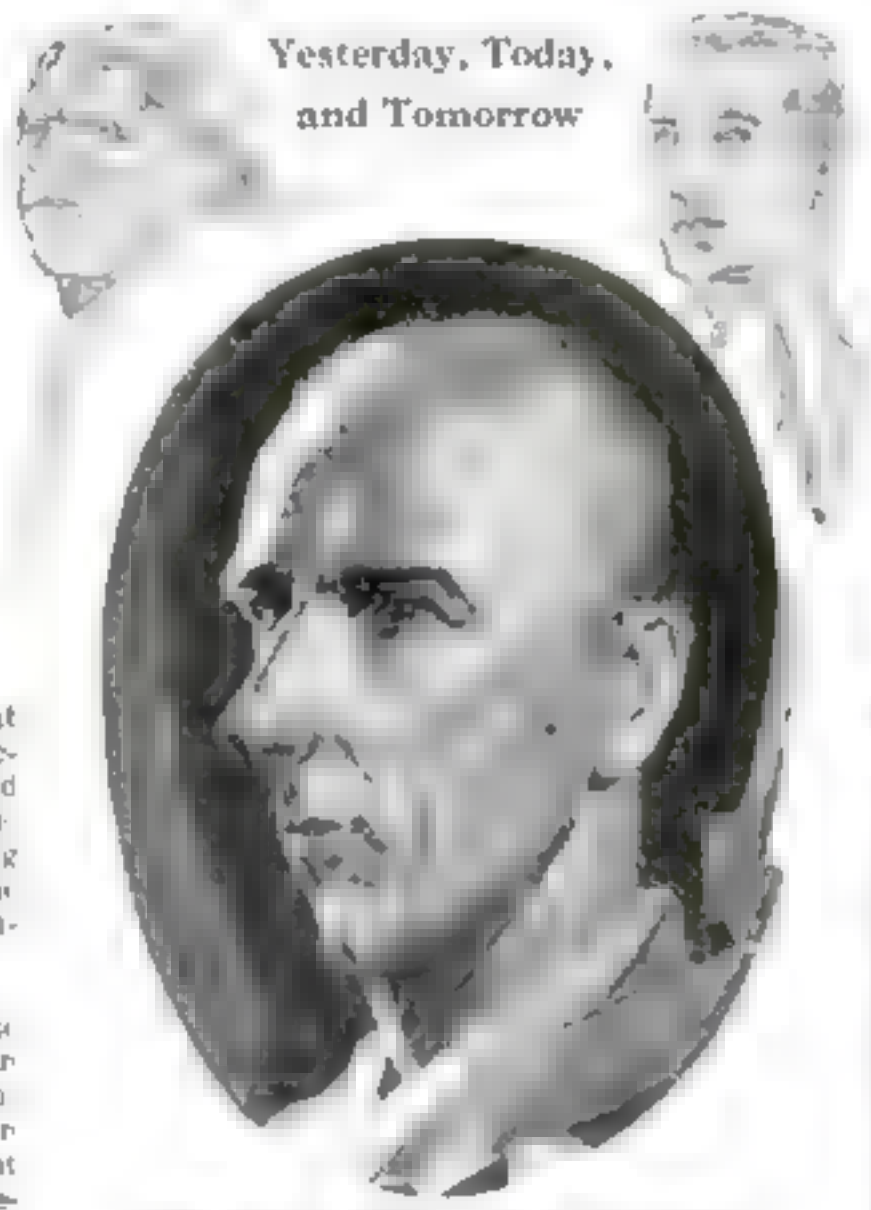
3. Our jaws are receding.

4. Our nose is becoming sharper, narrower, and more prominent.

5. Our eyes are becoming narrower, and are sinking more deeply into the face.

6. Our cheek bones are becoming less prominent.

7. Our whole face is becoming narrower.



OUR artist has pictured here how the face of man may appear a few thousand years hence, based on predictions by Sir Arthur Keith. He also has drawn a striking comparison between the face of prehistoric man and that of present-day man, showing how the processes of evolution have headed away from the powerful, virile features of our hardy ancestors, toward the "soft" characteristics predicted for future man. Evolutionists point out that the rugged features of the caveman were born of the fierce primeval struggle for existence, and that with civilization these characteristics have been softened.

Now, if these processes go on according to Keith's schedule, the human head is destined gradually but certainly to assume the proportions indicated in the illustration.

Those who dispute this and maintain that modern man has ceased to evolve, said Sir Arthur, usually cite the similarity between the modern and ancient Egyptians to prove their contention. Only 10 years ago, he himself believed that the evidence from English excavations led to the same conclusion. But his opinion was altered by his most important investigations, carried out in recent years.

He took 50 skulls (25 of men and 25 of women) from English graves that were known to be 1000 years old or more; some of them were as ancient as the Pyramids. He carefully compared these ancient skulls with those of corresponding men and women who had lived in England in the eighteenth and nineteenth centuries. The result convinced him that the changes noted above actually have taken place—actually are taking place.

WHAT is more, these changes are taking place much more rapidly than generally is supposed. The modern type of man appeared in Europe at the close of what is called the "Mousterian Period"—as lately as some 22,000 years ago. He was bigger in his brain, stronger in his jaw, and had a more rugged countenance than his direct descendants of today. Some of his characteristics have rapidly toned down, while others are becoming more accentuated. His prominent cheek bones have been sinking in; his rather flat and wide nose has been jutting forward and becoming thinner; his mouth is still getting smaller and his chin is receding.

"It may be said," declared Keith, "that the changes I have described are due to diminished use of the jaws in modern people. . . . I do not think we can accept this as a true explanation, for the changes I have described are confined to about 30 per cent of the modern population; 70 per cent show no such change, and yet all live on approximately the same dietary. The cause lies deeper than a mere disuse of jaws; certain stocks and families show these changes more than do other stocks and families. Such evidence as I have gathered points to an increasing frequency of these new characters during recent centuries. Apparently evolution makes its conquests in the way just described; progress is made by climbing the scale of percentages."

Snakes *Are* Safe *if You* Know

What I Have Learned of Venomous Serpents at the Strangest of Reptile Farms—A Cure for Deadly Bites

A Home for Reptiles

The only snake farm of its kind in Sao Paulo Brazil, where venom is used to make snake-bite serums. Below: How one of the attendants handles the deadly reptiles

The igloo-like snake houses are surrounded by a six-foot wall and moat

"TAKE this fellow, for instance—if he nipped you he'd leave enough poison in the wound to kill two or three men. You would die in fearful agony before nightfall. Your limbs would be swollen to twice their normal size, and your face distorted out of all semblance to your former self."

Joaquim, my guide at the Butantan snake farm, was speaking. Crawling about our feet were reptiles gathered from the jungles of Brazil and given free board in return for their deadly venom at this strange South American farm, the only one of its kind in the world. Collected at intervals, the venom is used in the manufacture of snake serum, practically the only thing that can save human beings from death when struck by a poisonous reptile.

As Joaquim sketched his encouraging picture of my hypothetical fate, he was hauling a dingy greenish reptile, four feet long, out from one of the small, dome-roofed dens that look like Eskimo igloos.

"A pretty specimen, isn't he?"

I couldn't agree with much enthusiasm.

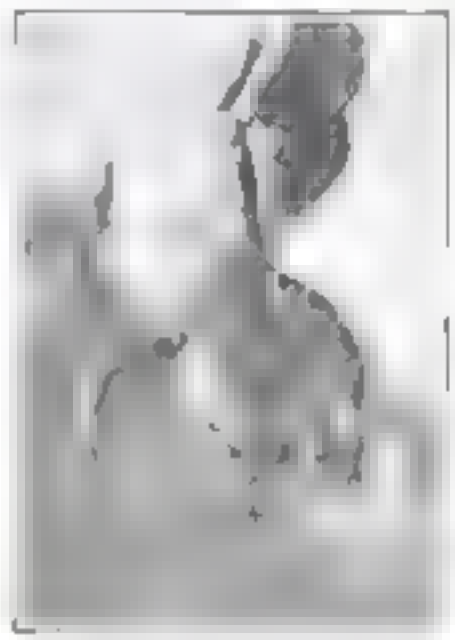
"He's a jararaca," said Joaquim. "The notorious fer-de-lance, you know. I've seen men suffering horribly within three minutes after a bite by one of these fellows, and losing consciousness within another five minutes. Death from such a bite used to be inevitable. Now our snake-bite serum will save a man when he seems to be already in the last throes."

Joaquim slipped the jararaca over the hooked end of a stick he carried, and we moved on. The reptile's head and tail dangled toward the ground, and his forked tongue flicked in and out as he writhed impotently.

Joaquim was using his grotesquely burdened stick to point out other reptiles that were wriggling sluggishly through the grass of the inclosure.

"Just don't step on them, and they'll leave you alone," he said reassuringly. "They couldn't strike through your gaiters, anyhow. All the employees here wear leggings, and that's the only protection they need.

"Here, take this one yourself," he urged, handing me the snake-draped rod he still was idly carrying. "Just hold him well away from your body, and you're safe. He can't reach you. He's helpless to do anything but writhe around unless he can get a good purchase on the ground. He can't strike unless half his body is on the ground, and he can't strike much more than a third of his length under any circumstances.



A Venomous Frog

Dangling a venomous Brazilian frog. Its poison causes blindness. Note the poison glands just back of the head

"Besides, they're all of them rather torpid these cold days," Joaquim added. "Look." He stooped down, seized another serpent right behind the head, and lifted him shoulder high for inspection. "A jararacucu, this little darling. One of our deadliest species. He'll inject a cubic centimeter of poison at a shot."

WITH fangs showing, the five feet of snake hung inert.

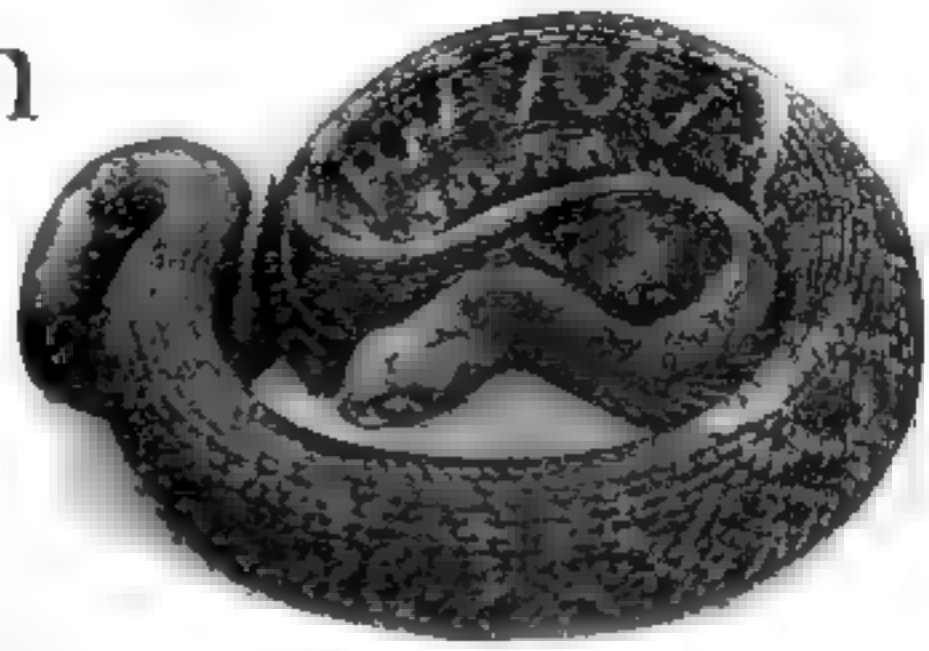
"One of the men in our laboratory was bitten in the finger by a jararacucu some time ago," said my guide. "Within half an hour he was blinded, bleeding at mouth and nose, shivering in a cold sweat and barely conscious. His whole arm was throbbing with indescribable pain. He was treated promptly with serum, but it was three days before he was fully recovered. Without the serum nothing under heaven could have saved him from a terrible end.

"Yes," Joaquim commented, holding the jararacucu up in front of his face and eyeing him coldly, "you're a tough customer, you are. But

How to Pet Them

By FRANCIS GOW-SMITH

The remarkable experiences of Francis Gow-Smith, former Purdue football star and now an explorer in Brazilian jungles—in the world's strangest snake farm, are particularly interesting in view of the recent visit to the same farm made by Raymond L. Ditmars, curator of reptiles in the New York Zoological Park. Ditmars, took with him a quart of rattlesnake venom produced by 2500 snakes, to be used in the manufacture of snake-bite serum for the United States



Huge Rattler Coiling to Strike

The rattler is one of the most feared of all snakes—slow to act, but savage and deadly sure when it strikes. Its rattles—the number of them varies with age—may be seen at the tail tip

you're sulky these days, aren't you? This fellow hasn't eaten a thing for two months," he added to me. "I've seen some of our snakes fast six months or a year But they aren't any the less poisonous when they're fasting"

He let the snake's dangling body slowly down onto one of the domes—then suddenly released his firm grip on the creature's neck and promptly departed.

"We don't take any chances, you see."

I TOLD him *I* hadn't seen him do anything *but* take chances so far, and I gingerly returned the snake he had consigned to my charge. I had come to the strangest snake farm in the world purely on business—not for the privilege of petting leashed lightning.

Fact of the matter is, I never did waste any affection on snakes. I've met them occasionally in the jungles, and I've seen Indians die horribly when bitten by them Uncanny in motion, staring unblinkingly with cold, beady eyes, snakes look at man across one of evolution's bridgeless gaps

After all, in an encounter with any other creature of the jungle, you fight more or less with the same weapons You recognize a common inheritance of brain and eye and limbs and claws. But the snake, that weird survivor of an ancient and mistaken experiment in evolution, belongs not to this world but to another geologic age. Brainless, stupid, blindly vicious, he kills anything in his path, by the most mysterious of means—venom. Venom, that age-old, atrocious agency of treachery. The ultimate explanation of its deadliness is still a mystery, even down here in Sao Paulo, where Dr. Vital Brazil, director of the Butantan Seropathic Institute, has accumulated more practical information about poisonous snakes, I believe, than any other scientist in the world.

DOCTOR BRAZIL makes the only really effective snake-bite antitoxin to be had anywhere. He's been working on this for a quarter of a century, and has become very much of a hero to his fellow countrymen. They look up to him almost with awe.

And no wonder. Even as it is, 5000 persons die every year in Brazil from snake bite, not counting nameless hundreds of Indians. At least another 20,000 are bitten and suffer gravely before recovery. The figures would be worse still were it not for Doctor Brazil's unremitting and energetic campaign against every species of poisonous snakes and his perfection and distribution of the antitoxins.

Snakes indeed are so grave an economic problem here that the government itself supports the Butantan Institute. Doctor Brazil estimates that reptiles cause his country a direct economic loss of $8,000,000 annually. Only India, with its 20,000 deaths caused annually by the sacred cobra, has a worse record.

Ever since I began exploring the mysterious hinterland of Brazil, I have thought of it as a region over which the menace of poison broods ceaselessly. I have been assailed by the poisoned arrows of the Chervantes Indians. I have seen men suffering from poisonous wounds inflicted by scorpions, centipedes, tiny flies, huge spiders, and even by fish and frogs.

As soon as I finish writing this I shall turn northward again, across the last frontier and into trackless jungles where unfriendly Bororos prowl. There is no antidote for the poison they use on their bone-tipped arrows. Frankly, I fear the snakes less, for the explorer seldom even sees a serpent. Yet it is folly to go into the jungle without snake-bite serum, and I came to Butantan to procure a supply.

Doctor Brazil tells me he is working to develop a serum to fight some of the other poison menaces. "We have a tiny fly," he says, "that bites and leaves only a red spot—no more annoying than a mosquito's bite. But gradually a sore develops, the infection spreads, and the whole limb rots away in ghastly fashion. I think we can conquer this with serum"

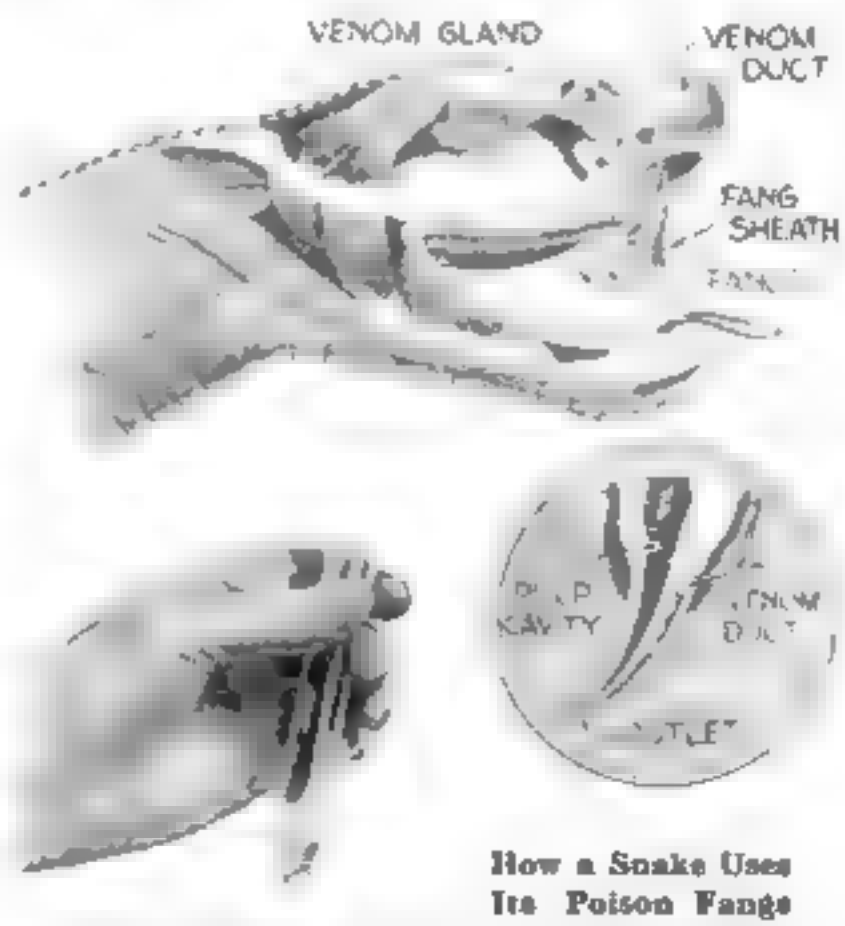
HE LED me into the laboratory and dangled a repulsive frog in front of my eyes. "His poison causes blindness." He put the frog aside to show me a monstrous spider, as large as a soup plate, that is nearly as dangerous as some of the five-foot snakes that wriggled over the lawns outside.

Yes," said Doctor Brazil, "we have a fine assortment of venom-using creatures down here"

The Seropathic Institute at Butantan, which is a suburb of the city of Sao Paulo, consists of the laboratories, the stables where the serum-producing horses are kept, and a number of walled inclosures for the snakes. Each inclosure, with its dome-shaped dens, is separated from the low surrounding wall by a moat to keep the teeming snake population where it belongs

AS WE picked our way through these inclosures, my guide pointed out the snakes that are most dreaded in Brazil. "That one with a dark gray pattern on a yellowish background is the surucucu. After the rattler's, his poison is the most virulent. He is swift and powerful and may grow 10 feet long. You've probably heard of him under the name 'bushmaster,' which in itself is dreaded by those who know it. You're more likely to meet one of these savage snakes in the virgin jungles, or near the streams, than any other kind. Look out for them.

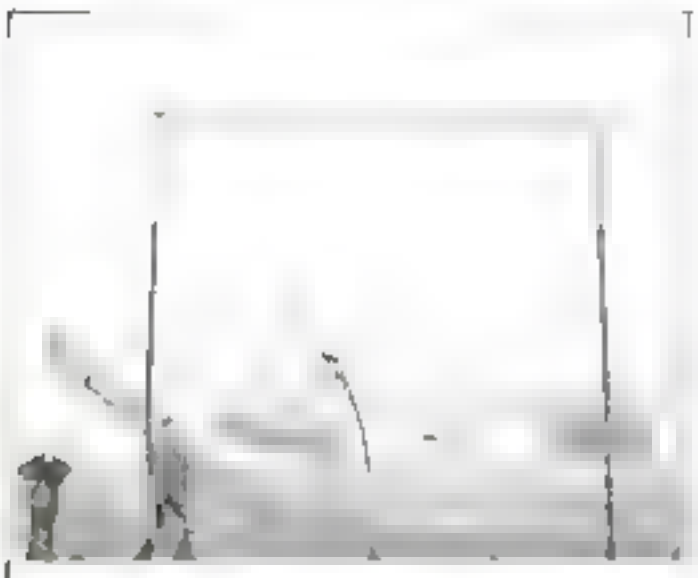
(Continued on page 134)



How a Snake Uses Its Poison Fangs

The upper drawing shows how venom from a gland in a rattlesnake's head is discharged through a duct that leads to the two fangs. These fold back when the jaws are closed, and spring down into striking position when they are open. In each fang is a venom outlet as shown in the circle. The test tube at the left holds one cubic centimetre of the amber-colored poisonous fluid discharged by a striking rattlesnake

Curiosities in Sport



World's Series in Duplicate

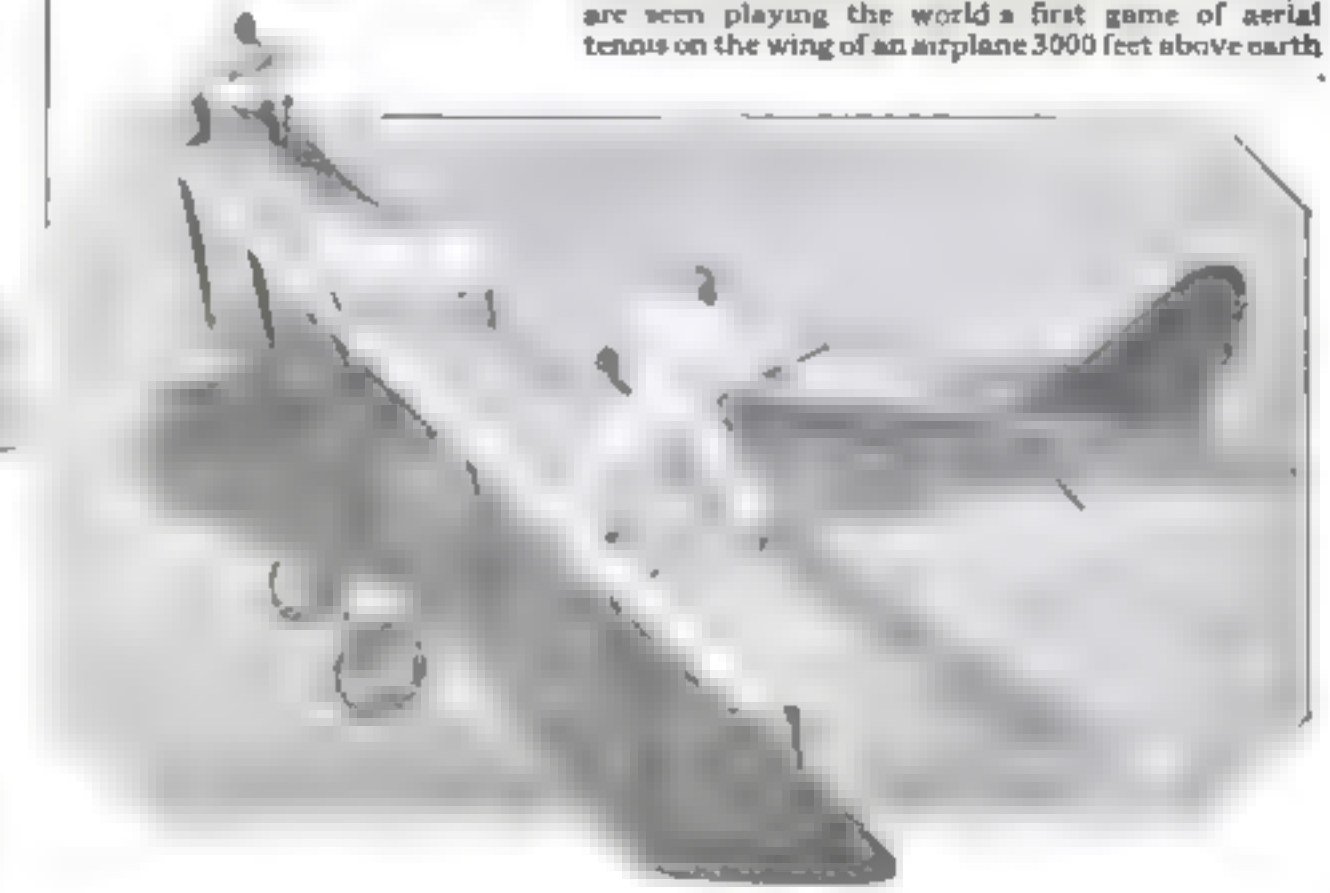
The electric signboard that tells the play-by-play story of a championship baseball game was eclipsed by a remarkably realistic scheme tried out in Louisville, Ky., during the last World's Series. Every move of the game was duplicated by real players on a real diamond with the aid of radio and telephone. Each "player" wore head phones connected with a microphone in the press box through an ingenious arrangement of wires running around the player's belt and down to the soles of his shoes, making contact with copper plates on the ground. The report of each play was transmitted through the microphone to the players, who then acted the play

When the Pole Snapped

Here are four of the most remarkable action pictures of a track event ever taken. They show Charles Hoff of Denmark, world's champion pole vaulter, at the moment his pole collapsed while he was attempting to break the record of 13 feet 9 inches at Colombes, France. A defect in the wooden pole caused it to give way at the center when Hoff had risen midway to the bar. Only by the narrowest margin did Hoff escape serious injury

A Dizzy Game of Tennis

If you want to get a real thrill out of tennis you might try the stunt pictured below. Gladys Roy, famous woman flier of Los Angeles, and Ivan Unger are seen playing the world's first game of aerial tennis on the wing of an airplane 3000 feet above earth



What a Cleaner Has Learned about You and Your Clothes

How automobiles, ice cream, lipsticks, and radio leave their marks on your apparel—The difference between a moth hole and a spark hole—Where stains come from and simple ways to remove them

By Watson G. Clark

A WELL known New York physician stopped his car the other day before one of our dry-cleaning receiving stations. He hurried into the store, dropped a package before the girl behind the counter, and was out again before she had time even to reply to his words:

"Can't wait a minute, Miss Larkin. But you know what to do with this—don't forget the creases!"

The girl smiled. She opened the package, took out the suit of clothes, examined it, and made some notes on a card. The doctor has brought his suits to us every three or four weeks for years, and every one in the establishment who has anything to do with men's clothing knows what he wants. He wants every smallest spot, visible or invisible, removed. He wants his trousers creased down to the cuff, but the cuff turned up uncreased. His sleeves must be rounded without creases, and he won't wear a coat unless the lapels are rolled. He hasn't varied these requirements in years. He would send the suit back if we forgot and creased the cuffs. But he has us trained now, and we never do forget

MEN who send us their suits for dry cleaning are more particular about the two creases in their trousers than any woman is about the plaiting of an entire skirt

Dry cleaning has more to do with the fashion of the creased trouser than most people think. Before dry cleaning methods were known, clothes had to be washed with water, which makes them a shapeless mass. Gasoline, benzine, and naphtha, however, remove soil without affecting the garment's shape. They retain even creases and plaits—the final pressing merely sets them in more firmly. Dry solvents, in other words, are chemically inert as regards the fibers of the fabric. This cleaning method isn't so old, either, as generally is thought. It dates from 1856, when a Frenchman discovered that camphene cleaned clothes without affecting the fibers. The whole dry-cleaning industry has grown from that simple discovery

Speaking of creases, a popular movie actor recently sent us two suits to be cleaned. Our boy delivered them, carefully wrapped in a box, but when the actor lifted them out, he said he couldn't use them. They were immaculate, but were not absolutely smooth where they had necessarily been folded in the package! Merely hanging them up would have remedied this, but he needed them for a set that afternoon, and the camera photographs every smallest hollow and pucker. Well, we took the suits back, resmoothed them, and delivered them that afternoon over the arms of uniformed boys from the movie studio.

Watson G. Clark, President of the Barrett Nephews Co., New York City, one of the largest dry-cleaning establishments in the world

"MEN are more particular about the two creases in their trousers," says Mr. Clark, "than any woman is about the plaiting of an entire skirt.

"Cigarettes and burned matches cause the most holes in men's suits. Moth holes come next. Battery acid from radio outfits is a close third.

"Every time I see a man resting his elbow on the counter at a soda fountain I want to ask him if he knows the risk he is running of ruining his sleeve.

"You can't tell a man's occupation from the suits he sends us. Judging from the appearance of the clothes we get now and then from some prosperous business men, they might be hod carriers.

"Chewing gum, malted milk, condensed milk, ice cream, indelible ink, road oil, perfumes, battery acid, lipstick and rouge—these are leaving the finger prints of the twentieth century on our clothing."

PEOPLE speak of the dry-cleaning industry as a laundering business. More exactly, I think, it is a chemical business. The removal of stains from clothing requires not only a knowledge of chemistry, but the equipment of a miniature laboratory. Our men customers appreciate this far more than women. They seldom attempt to remove stains themselves, but women almost always do, to the despair of our spotting department when the garment is finally brought to us.

For example, a woman the other day brought us a silk dress, pointing out a yellowish stain, which we later found impossible to remove entirely. She said she first had tried a solution of oxalic acid on a stain and, when this failed, had resorted to permanganate, without rinsing the oxalic acid from the fabric. Women who are otherwise of a cautious temperament seem to take the wildest chances when it comes to saving a dry-cleaner's bill.

IF THEY could see the modern equipment of the stain-removing department in a dry-cleaning plant, they would hesitate before taking even a grease stain out of a tablecloth! We call the man whose job it is to remove stains, the "spotter." The spotter's tools range all the way from an air gun to a card-index drawer holding stain-removing formulas. His stock chemicals, such as chloroform, acetic acid, ammonia, alcohol, benzol, and so on, stand within reach. So does another collection of prepared mixtures and sol-

vents. Other parts of his equipment are

A spotting bowl on a swinging arm, for stains that are removed best by stretching the fabric over the bowl and pouring a cleanser on the material

A vacuum tool that the spotter places underneath the stain, to draw off the solvent or water applied from above.

An atomizer or sprayer that may be operated by air pressure from a compressed-air tank.

A blower for quick drying

A swinging sleeve board for working on sleeves, and, of course, a small sink.

HOW do people get holes in their clothes? Cigarettes and burned matches cause the most holes in men's suits. Moth holes come next It is interesting to study these holes under a microscope, for the fibers then show up broken in a characteristic way, according to the cause of the hole. For example, pure silk, when burned with a cigarette, swells and forms a bead of char, easily distinguished under the microscope.

People usually are not sure themselves what caused holes in their clothes. When there is any question, we use not only the microscope, but also the litmus-paper test to determine the cause

For example, a woman came in the other day, much excited because her husband's suit came back from dry cleaning with three little holes in the back of the coat. She kept saying she was sure we had used corrosive "chemicals" on a perfectly good coat.

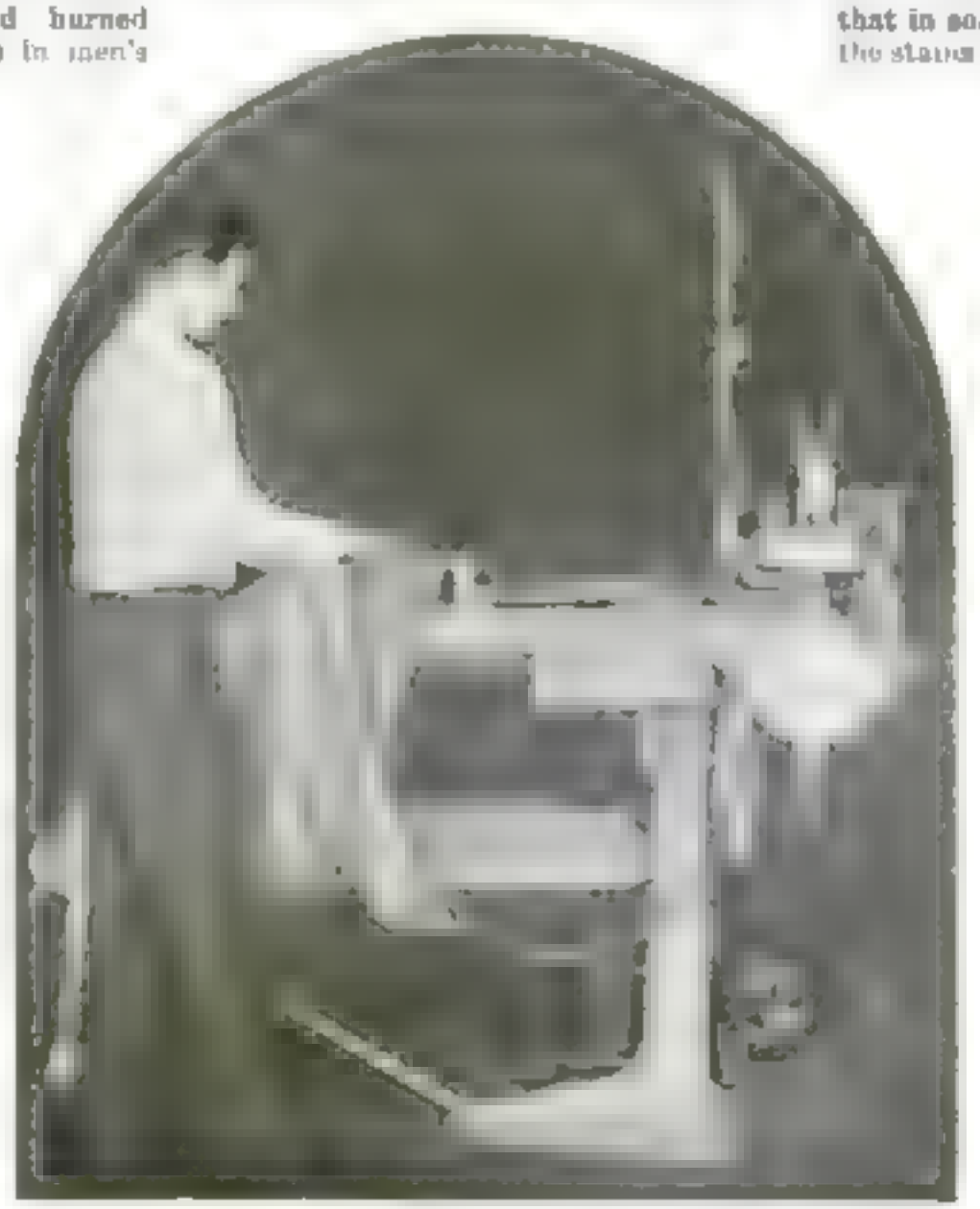
We took the coat to the spotting table and dampened the margin of the hole. We then pressed a piece of litmus paper to the dampened cloth. If acid had been present, the paper would have turned red, but it didn't. Then we pressed on a piece of red litmus paper—if the damage had been due to an alkali, the paper would have turned blue. But neither test gave a chemical reaction. So we examined the fabric under the magnifying glass. This disclosed a thin film, a snow-white, gauzelike structure, all about the hole, such as is formed by the attachment of a cocoon or some insect.

WE TOLD this to our woman customer, and she finally admitted that her house had been infested with moths last summer, and that she really hadn't examined the coat carefully before sending it.

Men who have radio outfits at home are close runners-up to moths, in the damage they do to the family wardrobe. A little battery acid on your hand and a light touch on a dress or coat, and a hole is almost certain to appear sooner or later, depending on the kind of fabric.

Battery acid is sulphuric acid, and thanks to the popularity of radio, it is one of the most destructive agents now causing trouble to the careful dry cleaner. The action of the acid may not be detected for weeks or months. Then, when the garment is sent to the dry cleaner and cleaned, a piece of the fabric, carbonized by the slow but deadly action of the acid, drops out. There is absolutely no way that the cleaner, prior to the accident, can know that the garment had been exposed to this destructive element, if the customer himself does not give this information.

Most people are amazed, too, to learn the number of other corrosive acids, salts, and alkalies commonly used around their own homes. The cuticle remover a



How Stains Are Removed

The "spotting" table most improved scientific equipment for removing stains from clothing is in reality a miniature chemical laboratory The "spotter's" tools range all the way from an air gun and vacuum cleaner driven by motor to a card index drawer holding formulas for stain removal. Stock chemicals, mixtures, and solvents stand within his reach

woman uses in manicuring looks colorless and harmless enough, but I have seen a skirt that once had been splashed with it become eventually peppered with holes The metal polishes, ink eradicators, and shoe cleaners in your home may contain oxalic acid, which puts holes in plant fiber and weighted silk when dried on the fabric. Corn and wart removers usually contain acids corrosive to fabrics.

Every time I see a man at a soda fountain spill soda on his coat, I want to tell him to wash it right out with water, even though it is apparently hidden in the fabric. Soda-fountain drinks often owe their flavor partly to acids that cause holes long after you have forgotten having spilled anything. Often these stains do not eat the fabric until heat is applied, which explains why holes sometimes appear in steaming, drying, and pressing.

The other day we received from a woman a fine bedspread, worth about $150. It was linen, embroidered with colored wool. In laundering, the color had run from the wool into the linen, and our job was to take out the color that had run. Our first step was to set the color of the wool. We then immersed the spread in a plain soap-and-water bath, swishing it gently around when immediately several large pieces dropped out of the fabric, leaving great holes. Nothing in the water bath could have caused this. What had happened was that in some previous attempt to remove the stains an acid, probably sulphuric, had been used and left in the fabric, to do its corroding work unnoticed

That same week we received from a hotel an Oriental rug. Upon examination, we found it contained a large hole, more than a foot in diameter. We thought it might have been caused by the battery acid from a radio set. On calling up the hotel, however, we learned that a tea table had been standing for more than a year over that particular spot. The combination of tea and sugar, spilled on the rug, had slowly eaten away a hole that took our Armenian weaver several days to mend

People often ask me if we can't tell a man's occupation from the clothes he sends us. Well, Mark Twain sent us his famous white suits at the rate of one a week, winter and summer, year after year. He wouldn't tolerate the smallest spot. If a drop of mud splashed on his trousers—off to the dry cleaner with the whole suit! But that doesn't prove that all of our white-suit customers are Mark Twains, or even writers

On the contrary, the remarkable thing to me is that you can't tell a man's occupation from the suits he sends us. We find business men, as a class, the most particular about their clothes. On the other hand, judging from the appearance of the clothes we get now and then from some prosperous business men, they might be hod carriers!

A DETECTIVE, perhaps, might make a pretty close guess at your occupation from the corroding materials traced on your clothes. If you are in the automobile repairing or manufacturing business, you are probably in daily contact with the sulphuric acid in storage batteries; the caustic soda in nickel iron batteries, soldering fluxes (hydrochloric acid) and so on

If you are a barber, you play around with silver nitrate for antiseptic, and alum and ferric chloride to stop bleeding. If you have anything at all to do with

(Continued on page 74)

Another Eclipse—What It May Tell Us

By **Newton Burke**

THE total eclipse of the sun last January presented to thousands of us the opportunity of witnessing a spectacle whose awe-inspiring splendor we shall never forget. Darkness creeping over the snow; weird, flickering shadows that appeared from nowhere, the dazzling sun gradually obscured until at a breathless moment the greenish gold corona leaped from the rim—these are the memories of a lifetime.

On January twenty-fourth next, early in the morning, the tremendous scene of a total solar eclipse is to be repeated, but this time for a select little group of scientists who await it in the jungles of far-off Sumatra and Borneo. But because the last eclipse was witnessed by the largest number of persons that ever observed one of those rare celestial phenomena, the coming eclipse is awaited with larger and keener interest, possibly than any previous eclipse. What new things will be learned about the sun, the moon, the earth, the universe?

Scientists from all parts of the world now are gathering in Sumatra, Dutch East Indies, and Borneo, where the eclipse's path is widest and where totality will last three minutes and 10 seconds. Dr. Heber D. Curtis, of the Allegheny Observatory, and Prof. John A. Miller, director of the Sproul Observatory at Swarthmore College, set out last September on their journey half around the world to witness the event. Professor H. T. Stetson of Harvard and Dr. J. A. Anderson of Mt. Wilson Observatory also went from America.

The Moon's Shadow

The path of the total eclipse of January 24 will extend from Africa to the Philippine Islands. The black portion of the band, 89 miles wide, represents the umbra or total shadow; gray portion the penumbra or partial shadow

Thousands of dollars have been spent in the transportation and setting up of scientific equipment, all on a gamble, for always there is the possibility that clouds will intervene and make all the preparations valueless.

Starting at dawn, local mean time, the path of the eclipse shadow will range from a point in Central Africa, south of the Sudan and north of Lake Victoria, along the equator, across the Indian Ocean to south Sumatra, thence to Borneo and Mindanao in the Philippine Islands. Radio will keep you informed of its progress as it sweeps over these distant regions at a cannon-ball speed of 1388 miles an hour. The total eclipse is due to arrive in Sumatra at approximately 2.25, local mean time. There the shadow of the moon will have a width of 89 miles. The eclipse will last two hours and two minutes.

IN THIS brief flash of time, while the moon passes between earth and sun, blotting the latter from view, the scientists will attempt to add a few more details to our understanding of the universe. For one thing, they will try to measure the light of the corona. An attempt to do this at Harvard University last year failed. The observers also may be able to determine the edge of the moon's shadow path on the earth. This observation involves the problem of the exact distance of the sun from the earth. If we could establish this distance, then man could measure all celestial distances.

Is Your Memory Really Bad or Just Badly Managed?

Most of us are too lazy to remember properly, says an expert—Useful tricks for recalling names, faces, and telephone numbers—Why a young man usually has a better memory than his father—A dozen ways to test yourself

By Robert S. Woodworth, Ph.D.

Dr Woodworth is Professor of Psychology at Columbia University and former Chairman, Division of Anthropology and Psychology, National Research Council

ONE day recently a young man came to me discouraged.

"I simply haven't any memory," he complained. "I never seem to be able to remember a thing I read."

"Perhaps you haven't given your memory a chance," I suggested. "Suppose we test it."

I tried him with numbers. To his surprise he found that he could remember nine numbers repeated to him successively, and even repeat seven backward. He learned to repeat a stanza of poetry in a full minute less than it took the average person, and in other tests he scored high

The fault clearly was not in his memory, but in the way he used it. He had been in the habit of reading passively without thinking while reading, without analyzing the important parts. He had given his brain nothing to remember

Many persons are like that, for recent psychological tests have resulted in the surprising but encouraging conclusion that most of us have more memory power than we realize. In other words, if you forget easily, the chances are that the trouble is not your memory, but the way you manage it. And you can improve your memory immensely by improving its management.

Can You Remember Pictures?

Study these 25 forms for one minute. Then turn to page 149, where you will find a group of 50 forms, among which these 25 are hidden. Check each of the forms that you remember scoring yourself one point for each one that you check correctly and deducting one point for each that you mark wrong. If you remember 7 out of the 25, it is a good score

The memory process involves three steps: (1) Forming connections in the brain, (2) Retaining these, and (3) Putting them into activity again when occasion arises.

Most persons who try to improve their memories believe that if they could retain facts, they would be all right. The truth is that no one can do much about this middle step. Your power there depends almost entirely upon your physical makeup.

Some brains are more plastic than others, and impressions remain longer in these than in others

Things begin to stick in the brain after three years of age, and from then up to 20 years the power of retention grows. From then to about 40 it remains the same, after which it diminishes. A man at 60 may seem to possess a better memory than the man of 20, but this is due probably to better judgment and organization of material than actual power of retention.

I know an old retired army officer who can sit for hours telling of his experiences in the Civil War. "What a remarkable memory!" his hearers exclaim. As a matter of fact, his feat is due to the reason that his memory has become poorer and he can remember nothing new. Daily events make so little impression on his brain, which is more or less rigid, that the early impressions are thrown into high relief

About the only way you can improve this power of retention is through general hygiene, which keeps your brain in good condition. Intoxicants and illness often weaken brain connections. But if you have good health and take care of yourself, you need not worry about retaining the connections. The important place to concentrate in improving your memory is in establishing the connections well by getting things into your head in a connected way. It is because of this that you can succeed if you deliberately set out to improve your memory.

First, however, it should be noted that improvement will come not in general memory power, but in special fields. Psychologists, after testing the memories of many people, say that training does not improve the general faculty of memory, but simply increases the ability to do a particular kind of memory job. If you want to remember faces, you must

Try This — — —

EACH of the numbers listed below has one more digit than the preceding one. Have some one read the numbers aloud to you, one at a time, allowing an interval of one second between each digit. After each complete line is read, you are to repeat it from memory as best you can. See how many you can remember correctly. Eight is a good score. More than 11 is highly exceptional.

1
6 7
3 4 9
5 1 2 7
8 4 5 8 3
9 2 2 6 1 7
4 3 6 8 2 7 3
1 7 8 7 3 3 4 6
9 2 5 1 3 2 7 6 4
8 4 3 5 6 1 5 2 9 7
2 5 9 1 7 6 8 6 4 9 5
7 3 2 8 4 6 1 9 5 7 3 8

— — — and This

BELOW are 10 sets of paired words. Read them over, associating each of the words in your mind with the opposite one with which it is paired. Now turn to page 149, where you will find the first words of the pairs listed in a different order. Opposite each write down its associate. After one reading you should be able to remember four or five of the associates; after two readings, seven, and after three readings, eight or nine.

freeze	design.
expensive	snake
table	lightning
overcoat	purpose
parlor	stretch
prefer.	instrument
tiger	music
unfair	smoke
fish.	guilty
sickness	unseen

practise remembering faces. If it is telephone numbers, practise remembering them. If it is dates, practise dates. You won't learn to remember names by practising on numbers.

This gives a hint of the first suggestion I make—that is, to improve your general background in the special field in which you want to improve your memory.

MUSICIANS have performed extraordinary feats of memory in their particular field. Mozart, after listening once to the choir in the Sistine Chapel singing music not available in print, went home and wrote the whole thing from memory. This amazing feat has become classic.

A number of years ago, I attended a performance given by "Blind Tom," an old colored pianist who had lost his sight. After his regular concert he asked any one in the audience to play any composition, saying that he would repeat it immediately afterward. Often, I suppose, this was easy, but the day I heard him there happened to be in the audience a skilled organist, who played a learned piece of his own composition. We watched eagerly to see what would happen.

Blind Tom was a little fussed and in one passage hesitated for an instant, but otherwise went straight through the piece. The organist said that he had done very well

NOW Blind Tom had not remembered that complicated piece note for note, but merely put together parts that were familiar to him. Through long study, musicians get to know phrases, successions of chords, and harmonies. When the organist played a certain phrase, Blind Tom grasped the idea instantly. To one who had no background of musical training, the feat would have been impossible.

Real-estate brokers seem to have amazing memories. They can tell you instantly about every tract of land for miles around—how much area each has, who's holding it, how much mortgage there is, and so on

But when you analyze it, you see that it isn't so much that they learned isolated facts, as that they have a background of general facts about local real estate that fit all cases. They hear, for example, that a certain piece of property is held for $5,000, but there is a heavy mortgage. To them this means that the owner has a small equity; that the property could be bought for very little cash. The price likewise gives them an indication of the size of the tract. All this goes through the real-estate dealer's mind when he hears the price. It is part of his job. He acquires naturally a background of facts without any deliberate effort to remember.

An actor, accustomed to the phraseology of the drama, can learn a long "part" very quickly. His memory seems remarkable, yet he would have just as much difficulty as any one else in pursuing a course in law, say, or learning the details of a commercial position. An actor who had appeared in several Shakespearean productions could commit to memory passages from an unfamiliar play by the same dramatist in almost the time that an ordinary person, or even an actor who had not appeared in the classic drama, would require to read them through intelligently.

I REMEMBER learning Spenser's "Faerie Queene." At first it took me 10 or 12 minutes to learn a stanza, but after memorizing 50 stanzas, I could do one in five minutes. What really was happening was that I was getting used to the author's archaic style. Remembering came easier because I was getting those aids or helps that come from the acquisition of a "background."

If you were trying to memorize the details of a radio circuit, and knew little about radio, it would take you many times as long as it would an engineer to whom all of the terms and ideas were familiar. All he would have to do would be to group together familiar facts. The actual amount of new learning would be small

Probably the most spectacular of memory stunts are done with figures.

There was a man named Ruckle in Germany who could repeat 45 numbers in succession, forward and backward, and perform other astonishing feats. If you examined his history, you noted that he was obsessed with numbers from childhood.

When he saw the combination of 313, he recognized it as a prime number, one that can't be divided evenly by any digit. He knew all the prime numbers up to 1000—they were old friends and to him as familiar as single digits. He knew all the perfect squares, the roots, and so forth Due to his background, he had a vocabulary of numbers of which you and I might be completely ignorant.

IF YOU improve your grasp of a certain subject, your memory in regard to new details of that subject will improve with it.

You can help yourself in getting the first connections well established by relating facts in large units—the larger the better. Blind Tom, the real estate man, and Ruckle illustrate this. The musician remembered whole passages instead of single notes. The mathematician remembered figures in combinations of three or larger, and the real-estate man remembered a group of related facts about a certain piece of property. Recalling a single fact in a related group brought all of the facts to mind. So in memorizing, try to link different elements together. If you can see them already bound, it means that much less work for you.

Interest in a subject helps a great deal in linking facts together. I know boys

(Continued on page 147)

How Many Objects Can You Remember?

Study this picture carefully for one minute and see how many objects you can find in the room. Then close the book and write down as many of the objects as you remember. If you remember more than 15, your score is good, 20 is excellent

A Test of Proverbs

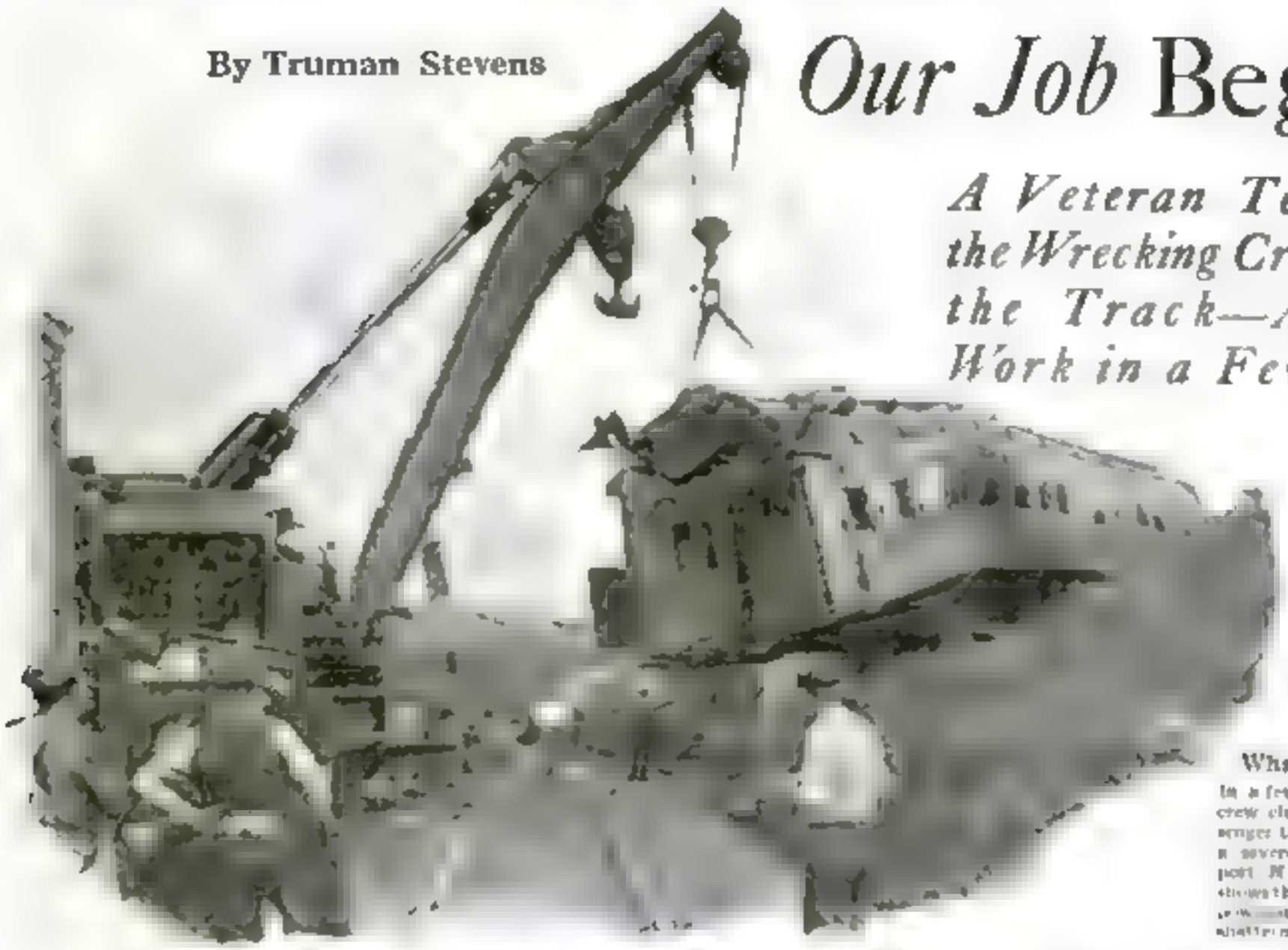
READ these proverbs over once, taking about two seconds for each proverb. Then close the book and write or tell some one as many as you can remember. You should be able to remember at least six.

Make hay while the sun shines.
All's well that ends well.
Haste trips up its own heels.
Enough is as good as a feast.
Great hopes make great men.
Brave actions never want a trumpet
A broken sack will hold no corn
Feast today and fast tomorrow.
All is not gold that glitters.
Pleasing everybody is pleasing nobody.
He who begins many things finishes few
Idle folks have the least leisure
One hour today is worth two tomorrow
Willful waste brings woeful want.
New occasions teach new duties.
A stumble may prevent a fall
Many hands make light work.
No news is good news.
Too far east is west
Gifts make beggars bold.
Caution is the parent of safety.
The sweetest grapes hang highest
Better late than never.

"When Trains Crash—Our Job Begins"

By Truman Stevens

A Veteran Tells How the Wrecking Crews Clear the Track—A Week's Work in a Few Hours



What a Storm Did

In a few hours the wrecking crew cleared away this passenger train wreck caused by a severe storm near Rockport N J. The photograph shows the wrecking crew with a steam derrick lifting a shattered coach off a hillside

EARLY one morning several months ago I was riding a sleeper on a flying trip from an Ohio city to New York when I was rudely jolted awake by a sudden grinding of brakes and lurching of cars as the limited came to a full stop. It so happened that the train had been speeding me to an important engagement in the metropolis that morning; and so, as I peered wide eyed into the darkness, it was with a feeling of dismay, a few moments later, that I heard the word passed down the line that there was a wreck ahead.

Two freight trains had collided—a moving coal train had crashed into a standing one. It was the kind of wreck every trainman dreads; for three of the four tracks of the line literally had been buried by the tangled wreckage of steel "hopper" cars and by piles of coal flung across the right of way by the crash. It was just the kind of a wreck, too, that might doom all my carefully laid plans for the day. Not only was I due in New York at a definite hour that morning, but my schedule gave me only four hours' time to transact my business there and to catch the only returning train that would take me back to Ohio in time for another and equally important appointment.

When eventually our train was switched over to the only clear track and we crept slowly past the scene of the disaster, the sight revealed by the first break of dawn was far from reassuring. Plowing into the standing coal cars, the locomotive of the moving train had flung itself on end and, breaking from its tender, had hurtled against a telegraph pole and keeled over on its side. There it lay, a dying monster, gasping and hissing, while a wrecking crew made ready a giant derrick to lift its remains. Here and there hurrying men with flaring torches were cutting away at the tangle of steel cars; others were digging into the scattered piles of coal.

The work of "clearing away" had started. It was a job, I figured, that would take fully a day, if not two, and it would be 24 hours at least before normal traffic could be resumed on schedule. I gave up all hope of making a return trip that day

Imagine my surprise when, after reaching New York and keeping my business appointment, I learned upon inquiry that the train on which I originally had planned to return would leave on scheduled time! The wreck had occurred shortly before five o'clock in the morning By eight o'clock, only three hours later, all three of the buried tracks had been cleared sufficiently for scores of commuters' trains to pass through! And before noon, when I passed the scene a second time, there remained little evidence of the early morning catastrophe

IT SEEMED the work of magic. That such a tremendous task could have been completed in a few hours so amazed me that at the first opportunity I sought out the freight trainmaster of one of the largest Eastern railway systems to inquire of him the secret of how it was done.

The trainmaster is the man on whom the burden falls whenever there is a wreck to be cleared. His is the job of rushing wrecking crews to the scene of disaster at a moment's notice, of directing the work of giant cranes and acetylene torchmen. In his quick-thinking brain rests the responsibility of restoring normal traffic in the shortest possible time. I found him to be a man of surprisingly quiet voice and manner—a man accustomed to give orders of life-and-death importance calmly, with the assurance that they would be instantly obeyed

"How is it possible," I asked him, "to clear away the wreckage of two steel coal trains in three hours?"

"A COAL wreck is the worst kind of a job we have to tackle," he replied "The only reason we can clean it up so quickly is simply that it *must* be done. At this moment thousands of freight cars and passenger coaches are clicking over the rails of our division. Hundreds of thousands of passengers are depending on us to carry them on time to their work and to their homes. Hundreds of cars are transporting coal to heat the homes and office buildings of a great city. Other cars are laden with tons of fruit and other perishable products that might be ruined totally by delay

"Just consider all that the movement of these cars means to the daily life of an immense population; and then think that anywhere, any time, some little mistake, some little piece of mechanism gone wrong, may throw a monkey wrench that will stop every wheel from turning. A towerman may 'daydream' for a brief moment; a switchman may pull a lever at the wrong time, a storm may undermine a single rail. Any one of these

things may paralyze a vast, smoothly running railway system."

The trainmaster paused, recalling, perhaps, disasters of the past

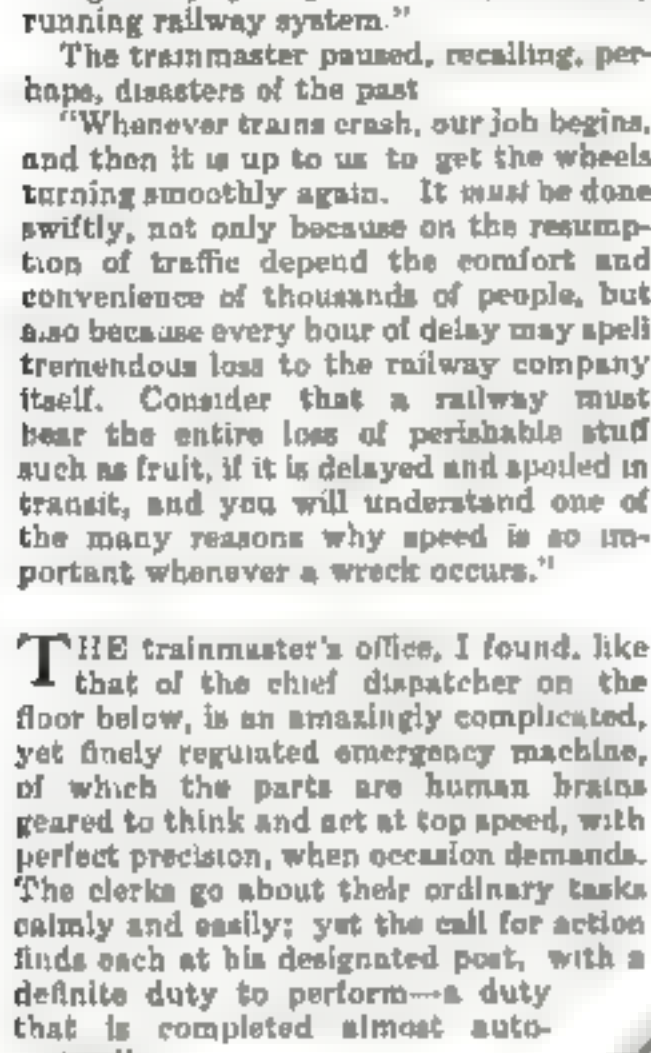
"Whenever trains crash, our job begins, and then it is up to us to get the wheels turning smoothly again. It *must* be done swiftly, not only because on the resumption of traffic depend the comfort and convenience of thousands of people, but also because every hour of delay may spell tremendous loss to the railway company itself. Consider that a railway must bear the entire loss of perishable stuff such as fruit, if it is delayed and spoiled in transit, and you will understand one of the many reasons why speed is so important whenever a wreck occurs."

THE trainmaster's office, I found, like that of the chief dispatcher on the floor below, is an amazingly complicated, yet finely regulated emergency machine, of which the parts are human brains geared to think and act at top speed, with perfect precision, when occasion demands. The clerks go about their ordinary tasks calmly and easily; yet the call for action finds each at his designated post, with a definite duty to perform—a duty that is completed almost automatically.

Imagine yourself, some howling winter night, in the office of the chief dispatcher. A telephone bell rings. Somewhere out in the storm an engineer, scalded and bleeding, has staggered half a mile down the track to one of the telephones that are placed along the line at intervals of a mile for just such emergencies. It is his voice on the wire. Number 47 is in the ditch—jumped the rails—fireman killed—passengers badly hurt—!

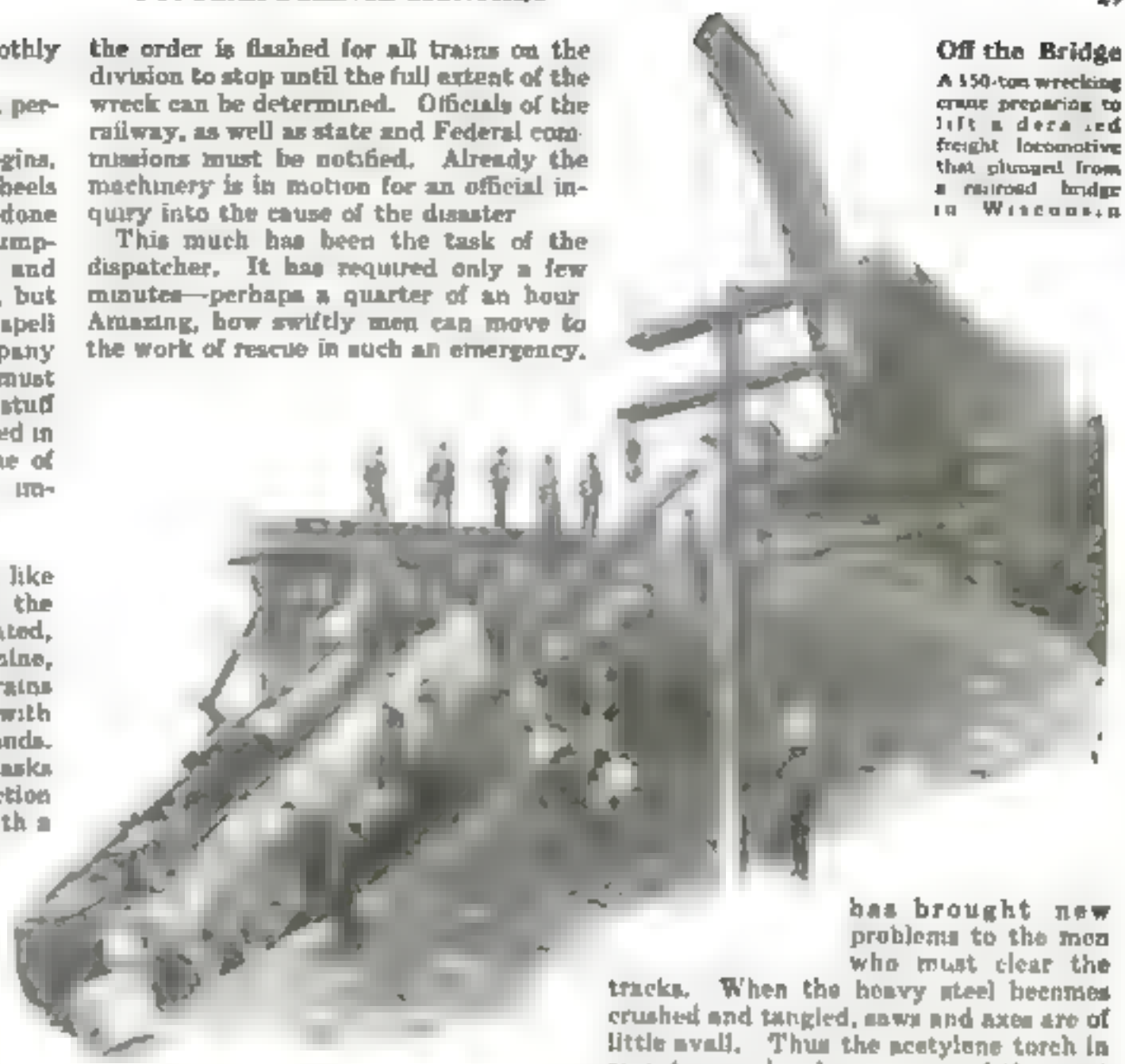
The saving of human life comes first. Instantly the call goes out for doctors, nurses, and ambulances. Simultaneously the order is flashed for all trains on the division to stop until the full extent of the wreck can be determined. Officials of the railway, as well as state and Federal commissions must be notified. Already the machinery is in motion for an official inquiry into the cause of the disaster

This much has been the task of the dispatcher. It has required only a few minutes—perhaps a quarter of an hour Amazing, how swiftly men can move to the work of rescue in such an emergency.



Your Life Depends on Him

The lonely track walker treads miles of railroad ties, tightening bolts on the rail joints to guard against the chance of derailment



Off the Bridge

A 150-ton wrecking crane preparing to lift a derailed freight locomotive that plunged from a railroad bridge in Wisconsin

"I remember one passenger-train wreck on a Western road," said the trainmaster. "An express, roaring along at 50 miles an hour, passed a certain block signal where it should have halted. In the signal tower an operator gasped, for he realized that a collision was certain; another train was speeding in the opposite direction on the same track. The operator jumped to the telephone and flashed word to the dispatcher. Doctors, nurses, and ambulances were on the way from the nearest point even before the collision had occurred'"

And now, with everything possible done to save human life and relieve suffering, the enormous task of clearing the rails begins. With the first report of the wreck, the trainmaster's orders have gone out to wrecking crews on duty day and night at several points on the division In half an hour a fully equipped wreck train, with mighty cranes capable of lifting 100 tons and more, is moving toward the scene of the disaster.

AFTER its arrival, while great mechanical arms lift locomotive and steel cars bodily from where they lie sprawled across the rails, desperate efforts are in progress to get traffic moving once more. If only two of four tracks are tied up, the problem is comparatively simple, for trains can be operated on the other two. If three tracks are out of commission, the fourth can be used. If four tracks are out, however, some kind of a detour must be arranged. Either a new track must be thrown around the wreck, or trains must be detoured over a branch line or over the line of another company

The use of steel cars, while preventing much loss of life and property in wrecks, has brought new problems to the men who must clear the tracks. When the heavy steel beenmes crushed and tangled, saws and axes are of little avail. Thus the acetylene torch in recent years has become one of the most important tools of the wrecking crew. Where brake rigging and running parts and bodies of heavy steel cars are massed badly, it saves time simply to burn them apart. Then the cut pieces can be lifted to the side of the track.

"THE most effective use of the torch I ever saw," the trainmaster told me, "was when two electric locomotives were wrecked at a tunnel entrance near New York. So tightly were they wedged at the entrance that they had to be cut apart. In the same wreck, the torchmen made a spectacular rescue of a trainman who had been pinned in an upright position in the vestibule of a steel car. In passenger wrecks sometimes the torches do great work in providing a way of escape for imprisoned travelers."

Steel railway equipment, too, has necessitated the development of wreck cranes of tremendous lifting power. In the New York terminal yards of a great railway system not long ago I found a derrick that within a radius of 17 feet will lift a weight of 150 tons, the strain of this weight being counterbalanced by outriggers. Two other derricks each had a capacity of 120 tons.

Thanks to improvements in safety devices, train wrecks are becoming fewer every year

"But still we have to be ready for them when they come," said the trainmaster. "We have to jump at a moment's notice to handle anything, from the derailment of one car to a crash that costs many lives and ties up an entire division."

"Why do wrecks occur? Well, there are three chief causes—failure of man power, failure of equipment, and acts of nature, such as storms.

"A storm is the one big cause that is

beyond human control. Only a few months ago a frightful derailment occurred in New Jersey because a heavy rainstorm had washed sand across the tracks. Another fatal wreck was caused when a windstorm ripped the top from a freight car and threw it across a passenger track. Floods also are a frequent cause of wrecks that not even the most far-sighted management can guard against."

AS FOR failure of man power and equipment, these are recognized as factors that can be controlled and reduced. The railroads long ago learned that only the man with a clear, healthy mind, free from worry, can be trusted to work under high tension without fear of making a fatal error that might take tremendous toll in life and property. A railroad man who brings domestic troubles to his job is regarded as a menace. By making their men happy and contented, the railroads more and more are endeavoring to prevent costly mental lapses such as that which occurred a few weeks ago on Long Island, when a trainman threw a switch while the wheels of a passenger train were passing over it.

At the same time the railroads are constantly extending the scope of automatic control as a check against human fallibility

Just this year automatic braking control mechanism was installed on the lines of at least three American railroads. Suppose, for example, that an express train, thundering through the night, passes a block signal. The engineer has collapsed at the throttle. A mile ahead on the same track, a freight train is lumbering up a grade. Just when disaster seems certain, there comes a flash of sparks from beneath the front trucks of the locomotive. Miraculously the express begins to slow down—50, 40, 30, then only 20 miles an hour. Now the freight is only half a mile ahead. A grinding of air brakes, an unseen hand closes the throttle, and the express comes to a full stop. A collision has been avoided without the touch of human hands. Such is the marvelous operation of the new automatic safety control

A Lesson to Reckless Drivers

How one American railway displayed a wrecked automobile as an object lesson to make other drivers think twice before trying the trick of beating a train at a crossing

HOW greatly the perfection of safety devices and the improvement of operating system and personnel have reduced losses from wrecks is evidenced by the records. In 1924, when 931,000,000 passengers were carried—about nine times the entire population of the United States—the fatalities from passenger wrecks were only 149—15 per cent less than the average for the preceding four years. Fewer railway employees were injured than in any year since the records were started in 1888. When you consider the vast network of rail lines that covers the country; when you consider, for example, that at one signal tower in the New York district 1400 trains pass in every 24-hour period, the record of railway accidents is truly remarkable

But there is one potential cause of train wrecks that even the most perfect system and the most ingenious safety devices, it seems, have not yet been able to control That is the ubiquitous automobile.

"There's nothing that worries the trainman more than the careless motorist at the grade crossing," said the trainmaster. "It seems almost incredible, yet there have been numerous instances where a stalled car has derailed and wrecked the train that strikes it. Nor is it enough, it seems, to have warning devices and swinging gates at the crossings. I know of one Eastern railroad that reports it has an average of one gate a day broken by motorists who insist on running on the track when the barriers are down."

HOW the careless motorist is regarded by trainmen was illustrated strikingly following a serious wreck near New York The automobile that threw the train off the track was buried beneath a tangle of steel freight cars on the edge of an embankment. Just as the members of the wreck crew were about to hoist the smashed motor to one of the flat cars that carried the train wreckage, the division superintendent interfered.

"Hold on, boys," he said. "Just leave that auto where it is, as a warning to other drivers"

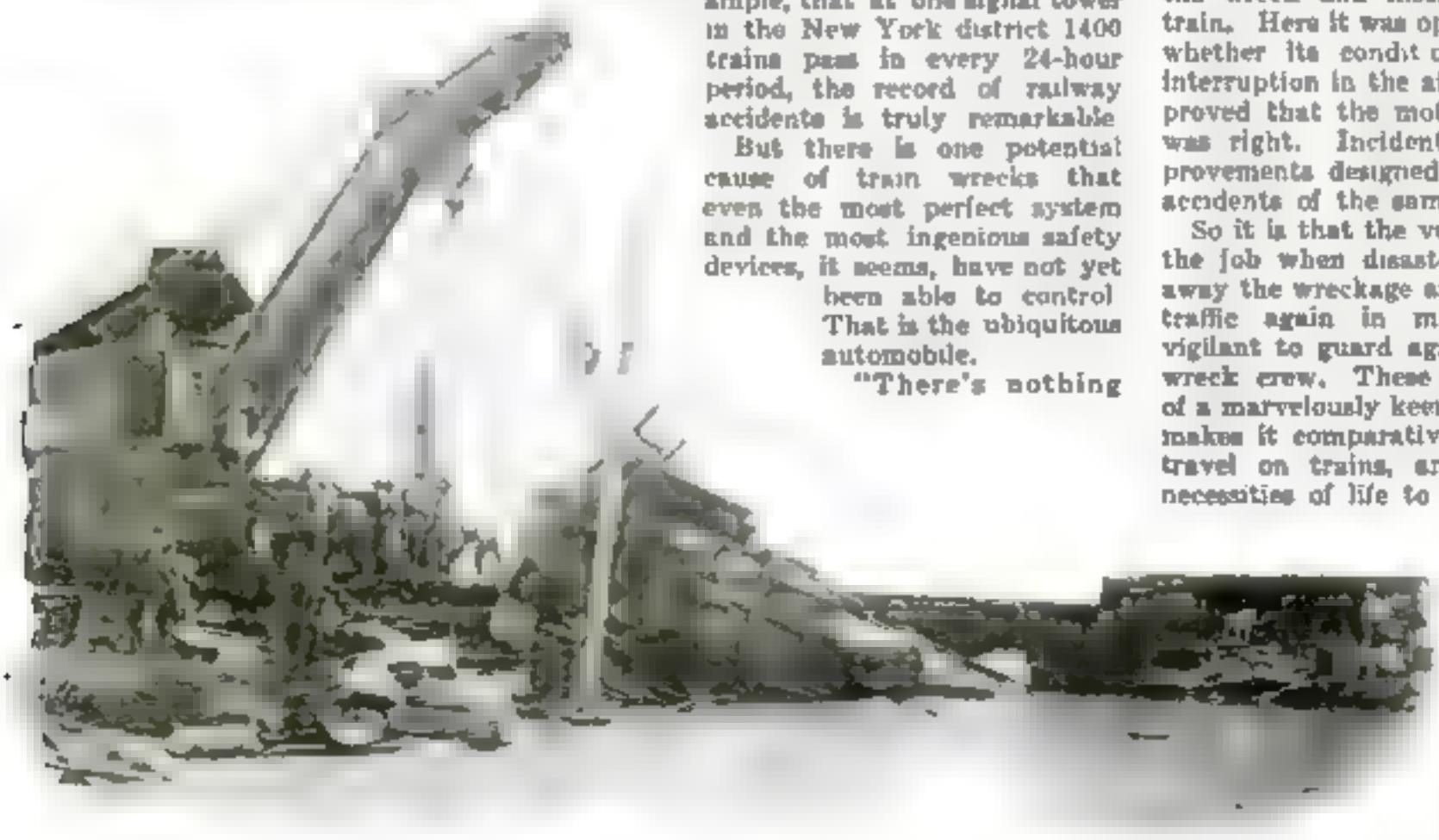
So the wrecked car was mounted on a pedestal at the crossing where every passing motorist could view it

In late years the careful investigation and determination of the cause of every wreck has been effective in preventing similar accidents. The old "cause unknown" no longer is accepted by the public nor by public commissions.

Very often the search for the cause is extremely difficult. An investigation committee will work for days at the scene of a wreck, but in the end they find a "lead" that brings a solution.

"IN ONE puzzling case a train hauled by an electric locomotive had crashed into a passenger train, killing several persons," said the trainmaster. "The motorman claimed the air-braking system was defective. To find out whether he was right, a device known as the angle cock, which was believed to have caused the trouble, was taken from the wreck and installed on a dummy train. Here it was operated to determine whether its condition would cause an interruption in the air system. The test proved that the motorman's contention was right. Incidentally it led to improvements designed to prevent further accidents of the same nature."

So it is that the very men who are on the job when disaster comes, to sweep away the wreckage and set the wheels of traffic again in motion, are equally vigilant to guard against the need of a wreck crew. These men are vital parts of a marvelously keen system that today makes it comparatively safe for you to travel on trains, and that brings the necessities of life to you.



A Heavy Pull

Pulling a locomotive out of a river on the Panama Railway Mechanical arms capable of lifting 100 tons and more aid the wrecking crews who work at top speed to clear the line for traffic

$1000 More in Cash to
Prize-Winners
in Our Great
"What's Wrong" Contest

Read the Correct Answers and See How Nearly You Were Right

Winner of the $500 Prize

M. Seklemian, of Los Angeles, Calif., with Mrs. Seklemian. Together they journeyed 62 miles from their mountain camp to send their winning entry

IF JOHN and Mary Newlywed had been surrounded by a group of neighbors such as the readers of POPULAR SCIENCE MONTHLY, never would they have been allowed to make the mistakes they did in their early bungling of jobs around the house. Such keen and astute critics you never met as those who pointed out errors in the third series of eight pictures in our great $10,000 "What's Wrong" Contest, which appeared in the August issue.

The August contest was remarkable for the fact that the number of contestants who found all the errors correctly was four times as great as for the July contest. Consequently the three judges faced the extremely difficult task of deciding which of the many correct sets of answers were presented in the clearest and most skilful manner.

After long and careful consideration they decided that the first prize must go to M. Seklemian of Los Angeles, Calif., who with his wife is pictured at the top of this page. Perhaps Mr. Seklemian remembered schoolboy lectures on the worth-whileness of persistence and determination. Anyway, in this case, his persistence brought him a reward of $500 in cash. While working on the August contest he and his wife were camping on the Tioga Road in the high Sierras. The nearest post office was in the Yosemite Valley, 62 miles away. Time for getting in the answers was short. So the two set out and made the trip across the mountains, covering the 62 miles to the nearest post office. From there Uncle Sam helped by speeding their entry to New York in an airplane. The answers reached the office of POPULAR SCIENCE MONTHLY just in time.

Mr. Seklemian's descriptions of the mistakes made by John and Mary, and of the deliberate errors made by the artist in drawing the pictures, were not only clear and accurate, but they were accompanied by excellent drawings of the Newlyweds doing each of the tasks in the correct way, with the artist's error in each case corrected.

Winner of the $100 Prize

Until he sees his picture here Wrayburn M. Benton, of Springfield, Mass., won't know that he is one of the successful contestants

The Three Best

THE first three prizes in the August "What's Wrong" Contest are awarded by the judges as follows:

FIRST PRIZE, $500
M. Seklemian
Los Angeles, Calif.

SECOND PRIZE, $100
Wrayburn M. Benton
Springfield, Mass.

THIRD PRIZE, $50
Joseph H. Glasser
Cleveland, Ohio

Names of winners of the other 65 prizes will be found on next page.

AT THE bottom of the page is the picture of a man who is going to be surprised – Wrayburn M. Benton of Springfield, Mass., winner of the second prize of $100. Until he opens his January issue of POPULAR SCIENCE MONTHLY, just as you did today, he will not know of his success in winning one of the prizes.

When we wrote to Mr. Benton, asking him for his photograph, he was out of town on a business trip. His wife sent the photograph, saying that when he returned she would not mention having received our letter, but instead would let her husband have the surprise of finding his picture in POPULAR SCIENCE MONTHLY.

"I want to be there when he sees it," she wrote. "He will be delighted."

Looking at Mr. Benton, would you suspect that he was a poet? We don't know whether he writes poetry for a living (confidentially, we suspect not), but it was through humorous verse that he chose to point out John's mistakes in doing odd jobs about the house.

JOSEPH H. GLASSER of Cleveland, Ohio, wins the third prize of $50. Just as Mary worked with John in putting up shelves and papering walls, so did Mrs. Glasser help her husband in figuring out the Newlyweds' mistakes.

"My wife and I spent together many interesting, somewhat perplexing evenings at work on the 'What's Wrong' pictures," he writes. In preparing their answers this young couple no doubt were aided by their own experiences, for it hasn't been long since they themselves started housekeeping. After putting to bed Joseph Glasser, Junior (a very important individual, aged one year), they got out their copy of POPULAR SCIENCE MONTHLY, and in the home-making struggles of John and Mary, they recognized some of the mistakes they themselves had made. Then Mr. Glasser got out his drawing board and very skilfully showed our artist just how the pictures should have been made. A snapshot of Mr. and Mrs. Glasser appears on the next page.

At the top of page 32 you will find the names of the winners of the five $10 prizes, as well as the 60 winners of the $5 prizes. See if your name is on the list.

Sixty-Five Additional Prize-Winners

FIVE PRIZES—$10 EACH

Jacob Kleiner, Richmond Hill, N. Y. Nina E. McLelland, Houston, Tex. Irene M. Thum, Brooklyn, N. Y.
Mr. and Mrs. Gustave C. Lundquist, Los Angeles, Calif Louise Gardiner Walshe, Jersey City, N. J.

SIXTY PRIZES—$5 EACH

Julius K Andersen, Arcadia, Calif
W F Armstrong South Gate Calif
Paul J Auxier Omaha, Neb
Wm E Barnaby Beverly Hills Calif
Edwin F Bramin Balboa Heights, C Z
H O Bumann, Savannah, Ga.
J H Coman, Durham, N C
Pay Lieut J O. Cossette Esquimalt B C Can.
Helen Culbertson Hanover Ind.
W S Cunningham, Shreveport La.
Edward P Drake South Bend Ind.
Frank M Dugan Utica N Y
Mrs P Arthur Erickson, Seattle Wash.
Chas V Fairchild Los Angeles Calif
Ed C Fleischman Detroit Mich.
Harland G Foster Brooklyn N Y
Angus W Gordon Louisville Ky
G A Graham, Baltimore Md
Milton A Graves, Evanston Ill.
David F Gray Kansas City Kan.
C R Greenwald, Columbus Ohio
George H Groth, Cleveland Ohio
Otto Alfred Hansen Brooklyn N Y
Walter C Harris Brooklyn N Y
F G Hill Fort Pierce Fla
F P Hodgkinson New York City
W B Hughes Wilmore Ky
John Internann, Rockaway Beach N Y
Mrs W A Jacobs Mt Vernon, N. Y
A B Kinney Lima Ohio
O B Laurent New Roads La.
Jos P Leahy San Jose Calif
J O Lips Louisville Ky
E H Lukenbill Harrisburg Pa.
Robert P Lyle Riverside Calif
John A Malm Denver Colo.
Mrs Clyde Mayne Austin, Tex
H S Merritt Los Angeles Calif
Henry J Meyer Jersey City N J.
Nicholas Michel Sulphur Springs Tex.
Tom H. Muse Washington Ind
Bernard Moeddel, St Bernard Ohio
E A O Brien, Portage la Prairie, Man., Can
William Otto Eaton Colo.
Orrin V Overton Janesville Wis.
E H Parker Hartford Conn
E M Riggs Dos Cabezos Ariz.
Halleck G Ranger Indianapolis, Ind.
A L Robinson Stockton Calif
Harrison H Schley Waukesha Wis.
H G Simmons Kokomo Ind.
Pearl Smith St Paul Minn.
Harry M Steed Portsmouth Ohio
Richard E Stifel Cleveland Ohio
Mrs Ivan R Stubblefield, Cincinnati, Ohio
Howard H Sweet Attleboro Mass.
L E Trueblood South Bend, Ind
Mrs C A Tryon La Salle N Y
Stephen A Yerko Washington D C.
Rogers O Young Jr Pawtucket, R I

A casual glance at the addresses of the successful contestants will show that they are scattered far and wide through the country

Every one of the thousands of entries in the contest was gone over carefully and the judges based their final decisions on three points—accuracy, clearness, and skill of presentation. Many of the contestants whose answers were presented in excellent form, fell short of winning one of the cash prizes simply because of some slight inaccuracy in their answers.

ONE more month and then all of John's and Mary's troubles will have been solved. If you didn't win a prize this month, there still is a good chance that you may be successful in the September contest; for the results thus far in the $10,000 Contest have shown that some of those who have been low on the list of prize-winners one month, or not on the list at all, sometimes have shot surprisingly to the top in another month.

Winners in the September Contest will be announced in next month's issue of POPULAR SCIENCE MONTHLY, and the winners of the Grand Prize Contest winners soon after that.

So that you can tell how nearly your own answers were right or wrong, the list of correct answers to the eight pictures in the August Contest are printed below. For each picture you were asked to tell, first, what John or Mary or both were doing wrong and why it was wrong; second, what deliberate mistake the artist made in drawing the picture.

In the following list of correct answers *A* in each case points out John's error; *B* is the deliberate mistake made by the artist in drawing the picture.

AUGUST CONTEST ANSWERS

Picture No. 1. *A*—John is hanging the screen door upside down. The smaller section of the screen should be at the bottom. *B*—The artist has drawn the woodplane with cutting blade reversed.

Picture No. 2. *A*—John has removed the whole faucet. He should have taken out only the valve mechanism. *B*—The artist has drawn the handle of the rake at a wrong angle with relation to the prongs, and the handle of the hoe at a wrong angle with relation to the blade

Picture No. 3. *A* John is nailing the edge of the board to the plaster of the wall. He should nail a wooden cleat to the wall for the shelf board to rest on. *B*—The back of the kitchen chair on which Mary is standing has been reversed by the artist.

Winner of the $50 Prize

Joseph H. Glauser with Mrs. Glauser in front of their home at Cleveland, Ohio. Aided by their own recent experiences in home-making, they spent many evenings together discovering the mistakes of John and Mary

Picture No. 4. *A*—John is nailing down the linoleum as he unrolls it. He should not nail it down until he has fitted the whole surface completely, and he should wait at least a day or two until the linoleum lies flat. *B*—The artist has drawn the calendar to show 30 days for August.

Picture No. 5. *A*—John is thinning out the paint with water He should have used turpentine. *B*—The drain plug for the trap on the kitchen sink pipe is shown on top of the curve instead of at the bottom, where sediment collects.

Picture No. 6. *A*—In tying the window weight to the new sash cord, John has left too much slack. The weight will strike the bottom of the compartment in which it slides before the sash is completely raised. He should have just enough cord to permit the weight to clear the bottom of the pocket. *B*—The artist has placed the sash-lift several inches from the center of the sash.

PICTURE No. 7. *A*—John is using a 50-cent piece to set the spark plug points. This will set them too far apart. He should use a dime. *B*—The artist has drawn the blade of the knife so long that it will not close into the handle.

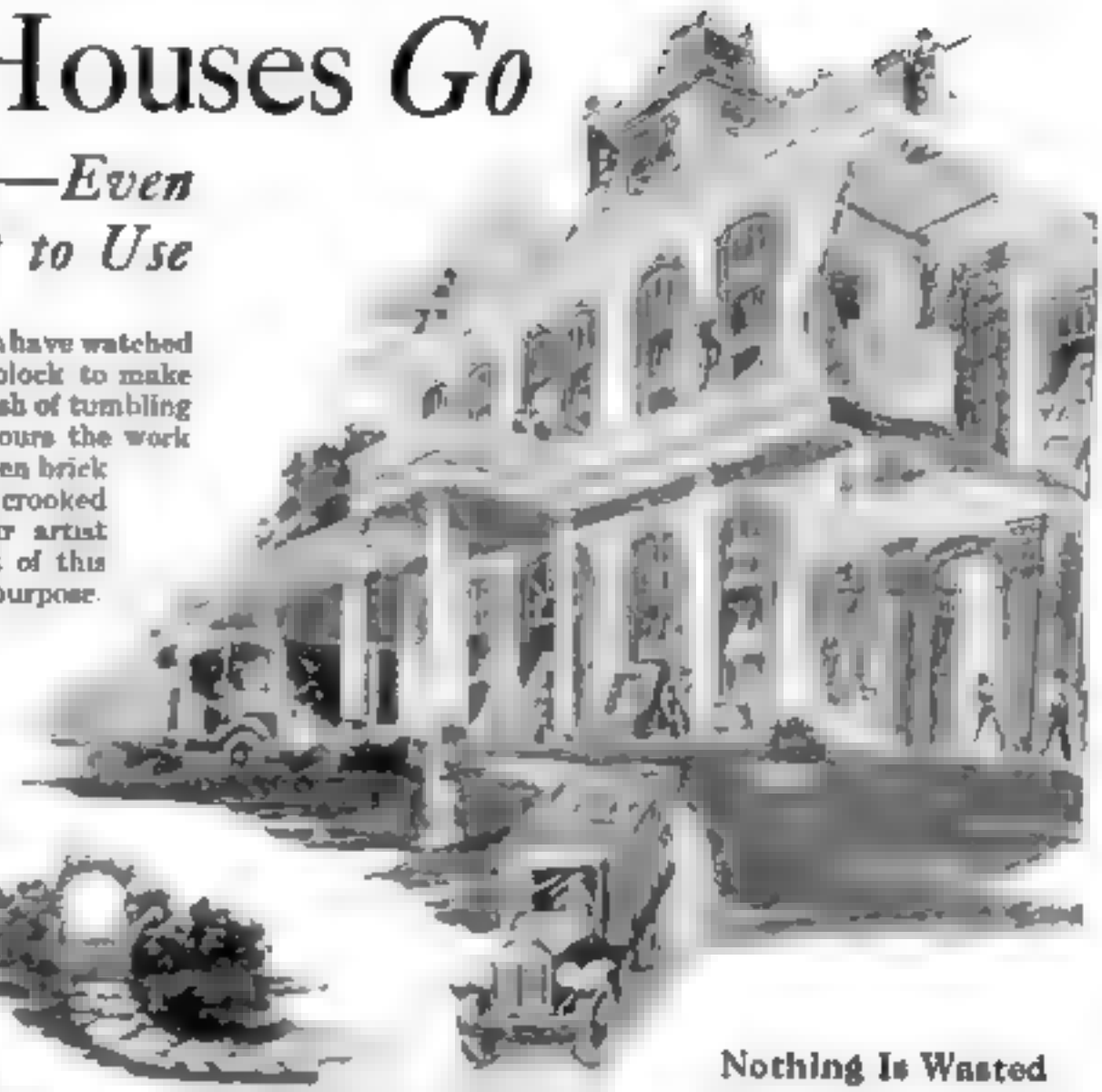
Picture No. 8. *A*—John is storing the cement on the ground. The dampness of the ground will ruin it. He should store the cement inside or place it on boards and cover with rainproof material. *B*—The artist has drawn John's shadow too high for any shadow cast by the sun.

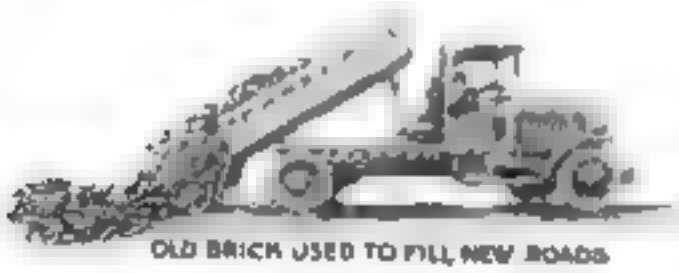
The names of prize-winners in the September Contest will be announced in next month's issue, together with correct answers to the eight September Contest pictures. Watch for the February number, on the newsstands January 10.

Where Old Houses *Go*

Every Scrap of Wreckage—Even Bent Nails—Can Be Put to Use

IF YOU live in a growing city, no doubt you often have watched workmen demolish an old house or business block to make room for new and larger buildings. In the crash of tumbling debris there is a strange fascination. In a few hours the work of months, sometimes years, can be reduced to broken brick or stone, shattered timbers, lumps of plaster, and crooked nails fit only for the dump heap. Yet, as our artist cleverly shows on this page, practically every bit of this "trash" usually is salvaged and put to some useful purpose.





OLD BRICK USED TO FILL NEW ROADS

FLAGSTONES RELAID AS GARDEN PATHS

GRANITE AND LIMESTONE UTILIZED FOR GRAVESTONES, MAUSOLEUMS AND HOUSE FOUNDATIONS

SCRAP METAL REMELTED AND USED AGAIN

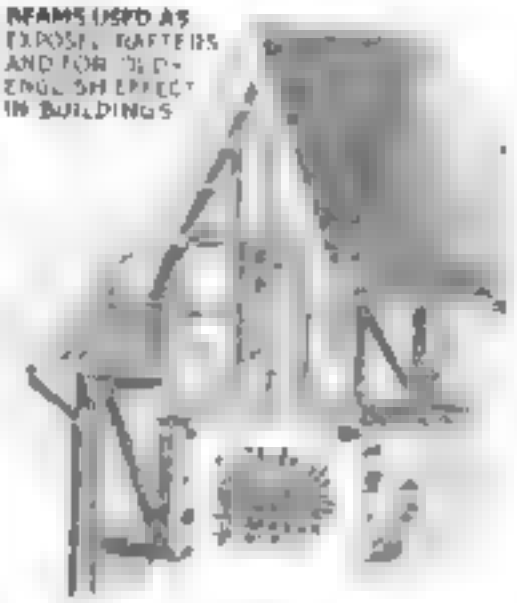
ALL SCRAP STONE CRUSHED FOR CONCRETE

WINDOW GLASS INSTALLED IN HOTBED FRAMES OR SHOWCASES

OLD BATHTUBS USED FOR CATTLE TROUGHS

TILES RELAID IN OTHER HOUSES

HAND-RAILS, STAIR TREADS AND MOLDINGS USED IN BUILDING CHEAPER HOUSES



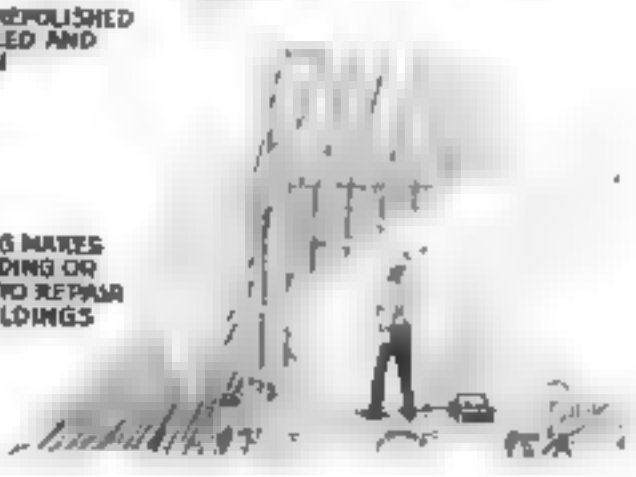
BEAMS USED AS EXPOSED RAFTERS AND FOR OLD-ENGLISH EFFECT IN BUILDINGS

PLUMBING FIXTURES REPLATED AND SOLD AGAIN

PLATE GLASS SOLD TO AUTO MANUFACTURERS FOR WINDOWS AND WINDSHIELDS

ALL PLASTER COLLECTED AND DUMPED TO FILL SWAMPY GROUND

DOORS REPOLISHED OR REMODELED AND USED AGAIN



FLOORING MAKES GOOD SIDING OR SERVES TO REPAIR OLD BUILDINGS

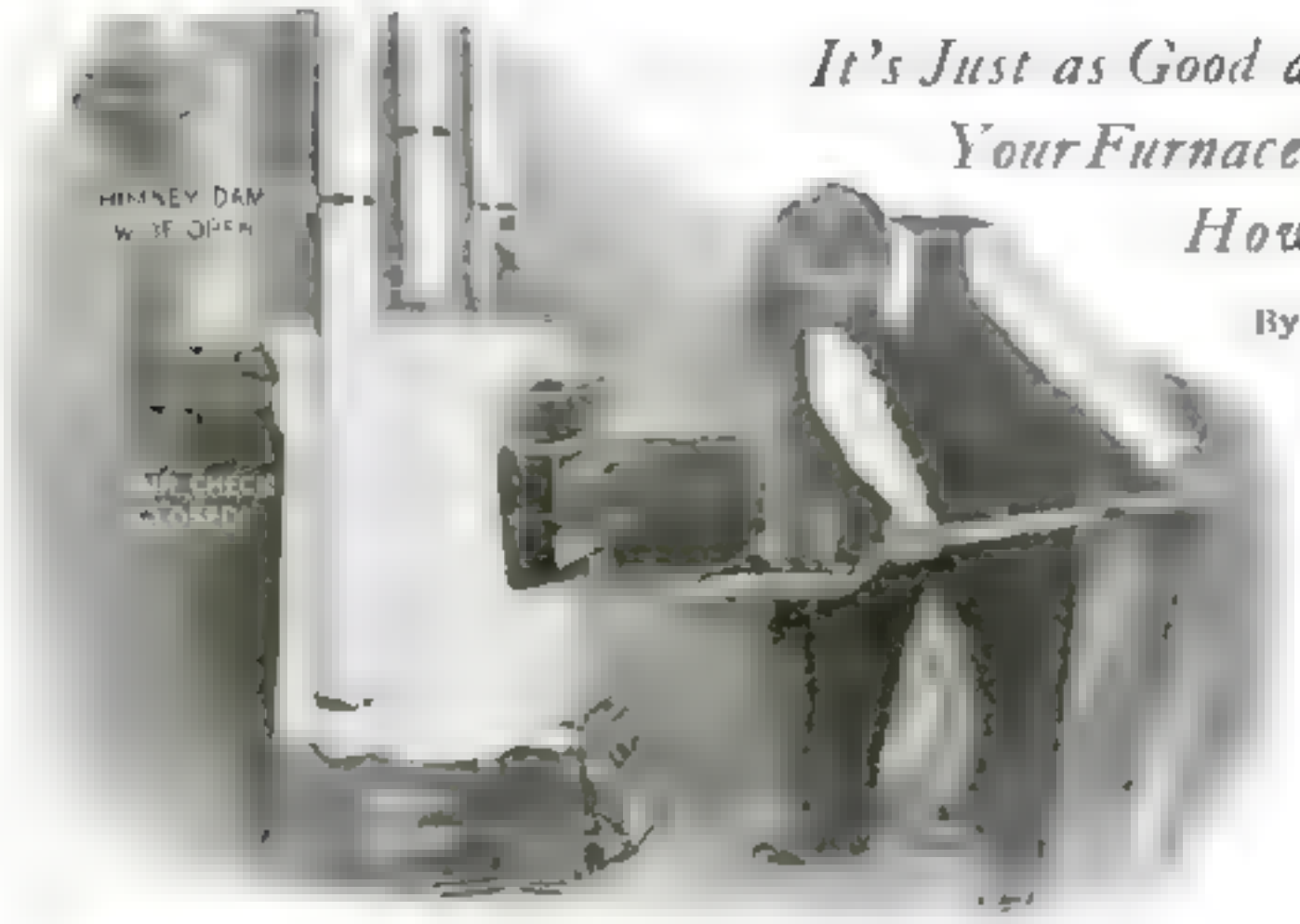
Nothing Is Wasted

Each truckload of wreckage hauled away from the house that is being demolished reaches a useful destination. Some of the more important uses are pictured here. Even the smallest bits of scrap metal are collected, melted, and used again. Usually lumber, stone, brick glass, and metals are sold on the site of the wrecked building, carried to yards on the outskirts of the city, and there reconditioned for sale to building contractors

Tricks in Burning Soft Coal

It's Just as Good as Anthracite for Your Furnace when You Know How to Handle It

By George Lee Dowd, Jr.



How to Prevent Gas in Fueling with Soft Coal

Since soft coal produces an immense amount of gas the instant it is added to your fire, it is necessary to keep the drafts closed and the chimney open when filling the furnace in order to prevent the escape of gas into your home. This photographic diagram shows the proper arrangement of the various furnace openings when fueling to avoid gas escape

WHEN, last fall, a strike shut down the anthracite coal mines, people who had been accustomed to burn this fuel were thrown into a state of panic. Many probably believed that they were likely to be frozen to death before the end of winter, because the impression prevailed that bituminous or soft coal, the most available substitute for anthracite, is an unsatisfactory fuel for domestic purposes.

As a matter of fact, properly used, soft coal is really just as good a fuel as anthracite and is considerably cheaper. Its only drawbacks are that it is a bit smoky and dirty and requires that more attention be given to the furnace. About 80 per cent of the domestic coal consumers in the United States never see a piece of hard coal from one year's end to another. With soft coal, they keep their houses comfortably warm and even use this fuel successfully for cooking. Many of those who always have burned soft coal, however, probably waste a lot of money each winter just because they fail to handle this fuel properly

While anthracite or hard coal contains only about 10 per cent of volatile matter that can be driven off in the form of gas, soft coal is 30 per cent volatile and in addition contains much tarry, sticky material. When you burn soft coal, then, you must keep in mind the gaseous nature of the material and take steps to insure the combustion of the excess gas.

The first point to remember is that a soft coal fire should not be banked with a large mass of coal shoveled into the furnace at random. Whenever you add soft coal to the fire, a great quantity of gas is produced almost at once. Consequently, if you bank the fire so thoroughly that the red hot coal is completely buried, the temperature of the top layer will not be high enough to ignite the gas and there is a good chance for an explosion. In banking with soft coal, therefore, you must be careful to pile on the fresh coal in such a way that at least one spot of red hot coal is left exposed to furnish a flame that will ignite the gas as soon as it is produced.

The second point to remember is that the tarry nature of soft coal causes it to form into lumps and cakes that impede the flow of air through the fire. This means that soft coal requires a good draft. Hence, you will have to keep the draft door open much more than for hard coal. The chimney damper should be open at all times, and it will be necessary to keep closed the door at the back or top of the furnace which, when open, allows air to flow directly into the chimney

WITH hard coal a gentle shaking of the grate twice a day usually is enough to dump all the ashes. With coke the shaking can be even more gentle. Soft coal, though, requires a great deal more attention in this respect. In addition to shaking the grate twice a day, it is necessary to slice the fire two or three times every 24 hours. By "slicing" is meant inserting a long poker in the opening just above the grate—sometimes called the "clinker door"—and heaving on it so that the end of the poker will lift up and break the sticky lumps and cakes. If slicing is not done properly and often enough, the draft will be cut off completely and the fire will go out

In order to supply enough air to burn completely the large amount of gas given off by soft coal, the fire door should be left ajar and the chimney damper should be open. This insures that air will be drawn in through the fire door and prevent the escape of gas into the cellar.

THE most efficient way to test the flow of gas or air through the fire door is to light a match and hold it near the crack in the door. If the flame is drawn into the furnace, you may be sure that no gas is escaping. Be careful, of course, not to make the match test unless flames appear above the fresh coal. Otherwise the match may ignite the unburned gas and cause an explosion

Many people do not realize that soft coal can be burned with entire satisfaction in the ordinary kitchen range, provided that the stove is equipped with a grate with reasonably small openings However, if your stove and chimney are not arranged to supply a good draft, soft coal cannot be used.

The rules for burning soft coal in the kitchen range are much the same as for furnaces. Put on small quantities of coal at a time, keep the chimney damper open at all times, do not remove the stove lids, and slow the fire down by lessening the draft. Break up the lumps and cakes with a poker at frequent intervals.

That you shovel fuel on the fire and remove ashes regularly does not necessarily mean that you are getting all the heat out of the fuel even if the house is warm enough

For real efficiency, three things are absolutely necessary in burning any kind of fuel, whether hard coal, soft coal, coke, or even wood. You must have air enough, you must have heat enough, and the air must be mixed properly with the fuel you are trying to burn. By mixed, I mean that the air must be mixed with the gases and in contact with the hot coals.

WITH these facts in mind you are in a position to make an intelligent examination of your own method of caring for your furnace, remembering, of course, that each kind of fuel requires a different treatment and that the size and type of your furnace, together with the

chimney arrangements, will affect results very materially.

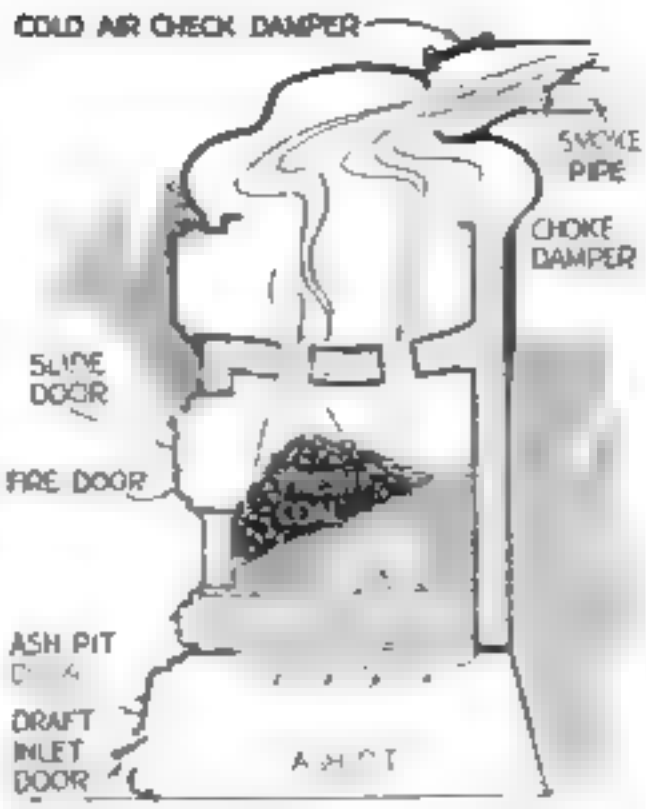
Of all the solid fuels, hard coal or anthracite is the easiest to handle. It is composed largely of pure carbon in a hard, dense form, with only a small percentage of material that can be roasted out of it in the form of gases when it is exposed to heat. Because of this, the average user gets fair efficiency out of hard coal, especially during cold spells when the furnace is being pushed to supply as much heat as possible. With hard coal, the falling off in efficiency occurs mainly when the weather is so mild that it is not necessary to force the fire. To cut down the draft and so reduce the heat of the fire during mild weather, most home owners set the fire door ajar. This permits cold air to flow over the fire in excessive amounts and to cool the furnace without economy of coal.

THERE is likewise a steady loss when a hard coal fire is banked. This is due to the wasted gases that are roasted out of the coal and sent up the chimney without being burned.

When you smell coal gas in your house you are wasting fuel. Most home owners are satisfied if they can adjust their furnaces so that this noxious odor is not detected, but the fact that you cannot smell coal gas in the cellar or upstairs does not mean that it is not being produced in the furnace.

The carbon in the coal unites with the oxygen of the air during the burning process in two different ways. If there is an ample supply of air, the result of the burning is carbon dioxide. When there is not enough air, the oxygen unites with the carbon to form carbon monoxide, a deadly poison. And you can be sure that if you smell coal gas in your house, this injurious gas is present.

Fortunately, coal contains sulphur and



The Right Way to Add Fuel

This cross-sectional view of a furnace illustrates the correct method of fueling with soft coal. The coal is added so as to slope down from the back of the firebox, with live coals exposed in the rear. Without this opening to the live coals, the fresh coal will form into a tarry mass that will extinguish your fire. Keep chimney damper slightly open

the sulphur fumes give you warning of the danger, for carbon monoxide in the pure form is entirely odorless. Coal gas always is produced to some extent whether you use hard coal, soft coal, or coke. It gets out of the furnace and into your cellar when the chimney damper is closed too tightly. This is true even when the fire door and the fire door damper are closed, because the gas will leak out around the cracks in the fire door of the furnace

TO MAKE sure that no coal gas comes out of the furnace, always keep the chimney damper open enough to permit a slight current of air to flow into the furnace through the cracks around the fire door and the chimney damper.

Coke as a fuel for domestic furnaces resembles hard coal in many ways and the home owner who knows how to handle hard coal will have no difficulty in burning coke.

Coke is what is left of soft coal after the volatile matter has been roasted out to make gas. The residue is nearly pure carbon in a light, porous form. It burns about twice as freely as anthracite. When burning coke, you can keep the draft door shut practically all the time. The fire door damper should be shut, too, since the gas-free nature of coke means that no air need be added above the fire to obtain satisfactory combustion. Coke weighs only about half as much for same volume as hard or soft coal, so you must not be sparing of this fuel when you bank the fire at night. Otherwise you may find the fire completely burned out by morning. Put on all the coke you can,

SO THE home owner in a section where anthracite is the regular fuel need have no reason to become panic-stricken over the prospect of a shortage in his favorite form of coal. If there happens to be a strike in the hard-coal mining industry, he can turn to soft coal or coke, keep his home warm, and at the same time cut his coal bill nearly in two!

There is just about as much heat in a ton of soft coal as there is in a ton of anthracite and with a little intelligent study of the simple rules for burning soft coal efficiently, you will find that soft coal makes a very satisfactory fuel. Really, the only disadvantage of soft coal is that it requires more attention and it produces a relatively large amount of smoke. That is the only reason that soft coal is not popular where hard coal can be procured.

A Daily Schedule for the Operation of Your Furnace

BITUMINOUS OR SOFT COAL

Before breakfast:
Open chimney damper. Shake well, using slice bar to remove clinkers and stir up fire. Add a small amount of coal. Leave fire door open. Ashpit draft should be open.

After breakfast:
Add more coal. Leave fire door open. Adjust ashpit draft as needed.

During the day:
Add coal at least three or four times. After each firing, the fire door should be left partly open for a short time and then closed somewhat. If coal clinkers badly, grates should be shaken or sliced at least once during the day.

At night
Fire should be shaken down and sliced until it appears bright and clean, with a good red glow in the ashpit. Put on plenty of coal. Be sure to leave small red hot spot uncovered. Close ashpit draft, partly close chimney damper and leave fire door ajar

ANTHRACITE OR HARD COAL

Before breakfast
Open chimney damper Shake fire to remove ashes. Put on fresh coal, just covering fire. Close fire door. Open ashpit draft door. Remove ashes.

After breakfast:
Add more coal, check chimney draft, close ashpit draft and regulate chimney damper

During the day:
The smaller the coal, the more frequent the firing. With furnace coal one firing at noon should be sufficient, with another before or after dinner.

At night:
Shake until red glow can be seen in ashpit. Bank fire by using sufficient coal to cover all bright spots until top of fire is entirely black.

COKE

Before breakfast:
Open chimney damper. Do not shake much, since a coke fire should not be disturbed any more than necessary. Shake just enough to remove ashes. Shovel on as much coke as furnace will hold, and close fire door tight. Open ashpit damper a trifle and regulate chimney damper

After breakfast:
No attention needed at this time.

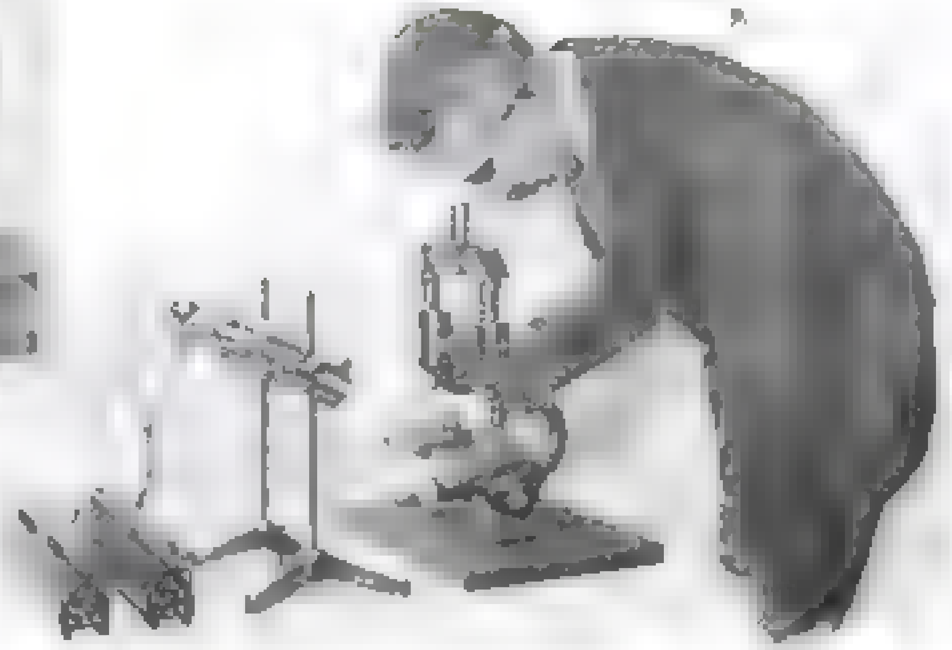
During the day:
Since coke burns freely, the firing should be frequent, probably as often as with soft coal. Shaking and slicing during the day should not be necessary, unless the coke is of poor grade. The heat regulation should be done entirely with the chimney damper

At night:
The fire should be well cleaned, since coke does out easily and quickly. In banking, shovel in all the coke you can cram into the door All dampers should be closed except the chimney damper. Keep that open just enough to avoid coal gas in the house.

Tracking *the*

Reading Murder Clues in Gun Barrel

Above: John H. Fisher examining th[illegible]



On this and on the following page you will read of discoverers who daily are adding to the sum of human knowledge, and of their most recent contributions to the scientific progress of the world.

Every Gun Leaves Its Mark

NOT infrequently projectiles figuring prominently in criminal cases will reveal upon their surfaces abnormalities that may have been caused by defects within the barrels through which they have passed. Such a point was at issue in the recent murder trial of Gerald Chapman, and there existed considerable difference of opinion as to the actual causative agent that had produced certain markings on bullets in evidence.

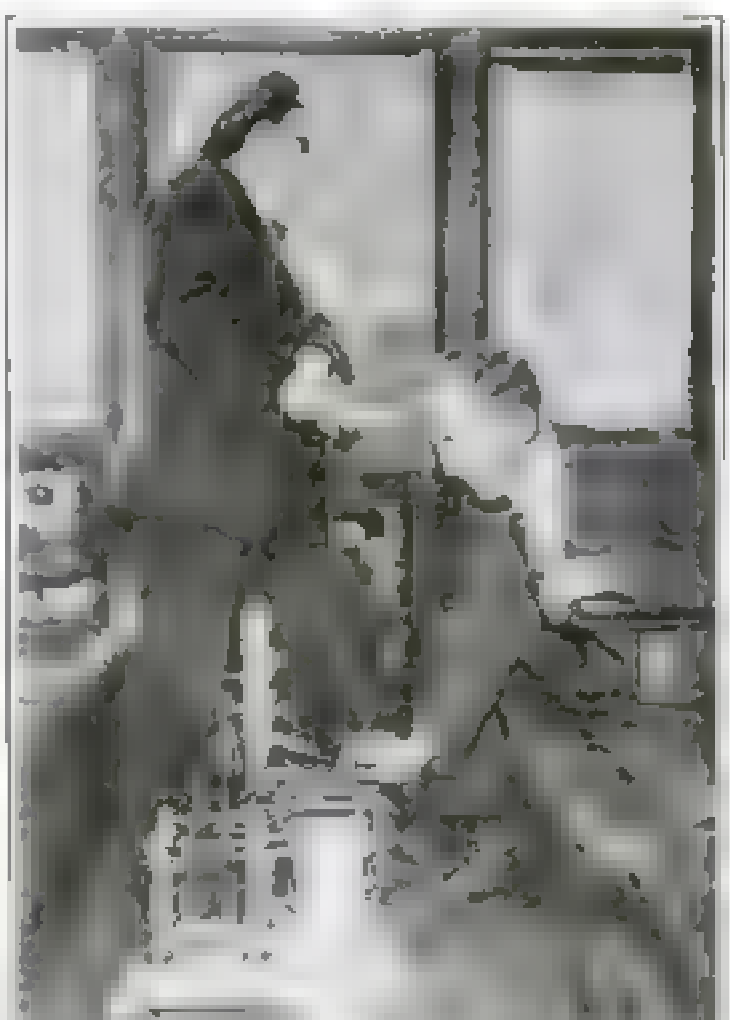
An examination of the gun barrel to settle the matter could have been adequately carried out only by sawing it in two lengthwise, and thus destroying its value as evidence. Future questions of this kind are not to be left unanswered, however, for a group of New York arms experts—Charles E. Waite, Major Calvin H. Goddard, Philip O. Gravelle and John H. Fisher—were even then working upon an apparatus that solves the difficulty without the least injury to the arm.

The problem before them was to devise a mechanism that would illuminate any desired area of a pistol barrel from .22 caliber upward, and at the same time permit a clear view of the field under examination. A modification of a surgical cystoscope and a graduated circle with vernier attachment added was finally evolved and fulfilled all requirements. Recently they completed this remarkable instrument called a "helixometer," which makes it possible to examine through a microscope every portion of the inside of a revolver or rifle barrel.

Through long researches Waite has established the fact that no two rifled revolver barrels ever are exactly alike. Although made with exactly the same tools, the minute grooves and elevations made in the rifling of the two barrels will, according to Mr. Waite, always mark the bullets fired from the barrels in such a way that his machine always can identify them beyond question.

In the picture at the top of the page, Fisher is at work examining the interior of a murderer's revolver barrel. At the end of the tube inserted in the barrel is a tiny lens and a microscopically small electric light bulb. With this instrument it is possible to examine the interior of the barrel for flaws that might be reproduced on a bullet fired through it, such as actual defects in the metal, rust patches, lead or other metallic fouling, and to note the effect upon them of repeated firing, cleaning, or other procedures. In addition, it is possible to measure the twist of the rifling most accurately. Since no two manufacturers use exactly the same twist, this measurement is important in establishing the source from which the weapon was obtained.

In the right hand illustration above Gravelle is seen using the second of the remarkable instruments. This consists, essentially, of two complete microscopes connected by a prismatic arrangement so that the two images can be made to overlap. A bullet taken from a murder victim is mounted beneath one microscope and a sample bullet shot from the suspected gun is mounted beneath the other. Strong light is thrown on both bullets in such a way that the infinitely small scratches and grooves produced by minute irregularities within the barrels are brought into prominent relief. By turning both bullets carefully, it is possible to compare the markings on one bullet with those on the other, and if it is found that they correspond exactly, doubt as to whether the mortal bullet came from the suspect's gun is entirely dispelled.



Flaws in Railway Tracks Recorded

Defects in railroad track can be detected quickly and easily by this new clockwork registering machine. Installed in a coach it records on a roll of paper all vibrations and jolts when the train is running at high speed. The photograph shows officials of the London Northeastern Railway of Great Britain testing track with the device

Cheap Fuel from Dust

IF YOU pump cornstarch with air into an inclosed tube and ignite the mixture with an electric spark, it will explode. Recent government experiments have shown in dust great explosive energy going to waste. It is this that is utilized in a new fuel announced recently.

Fuel made from dust or scourings, not only will make use of waste material, but will reduce a big potential fire hazard in manufacturing plants, explains W. A. Noel, an engineer of the Bureau of Chemistry of the Department of Agriculture. It would solve the problem of cheap fuel for factories, he adds, for it may be used in steam or gas engines.

Wood, metal, leathers, chemicals, cork, rubber, sugar, grain, cocoa, and cinnamon are but a few of hundreds of products from which the inflammable dust may be obtained. Probably the most powerful of all dusts is that of aluminum, while grain dusts are available in the greatest quantities.

Killer *by His* Bullets

An Amazing Crime Detector—Other New Discoveries and Inventions

To Silence Riveting Din

THE terrific nerve-wracking din of riveting guns in the construction of steel buildings will be silenced within a few years, according to A. G. Bissell, general engineer of the Westinghouse Electric and Manufacturing Company Arc welding will replace the rivets.

Welded joints now are used in airplanes and ships, and a few skyscrapers already have been constructed noiselessly. Only a few more steps need be taken, Bissell predicts, before the method will be recognized through the country as not only practical, but as a cheaper and better method of construction.

The workman is equipped with a fiber hood and wears glasses to protect his eyes from the glaring light. A closely woven suit, a leather apron, gauntlets and bellows-tongued shoes protect him from flying incandescent particles. He works in a welding booth inclosed on at least three sides, but with provision for enough ventilation to clear the booth of fumes.

Corsica Floating Eastward

A FRENCH officer, Commandant Helbronner of the Geodetic Service, who has been making a survey of the island of Corsica, recently made the startling announcement that it was floating away In the last 100 years, he estimates, it has moved eastward a distance of about 33 feet, away from France, its owner.

This curious discovery would fit in with the theories of geologists who suggest that the earth's crust is shifting horizontally. A journalist in Italy suggested humorously that the people of Corsica would rather be Italian than French, and therefore are riding toward the land of their preference.

A Substitute for Vaccination

AFTER 27 years of research, Dr. Mervyn Henry Gordon, of the Medical Research Council of Great Britain, has announced a discovery that in some circles is considered as important as the recent discovery of cancer virus. He claims to have found a way to immunize persons from smallpox and other diseases without vaccination.

Merely by sniffing through the nose a solution of dead germs properly heated, or passing through a room filled with immunizing vapor, it is said, persons will become immune to certain diseases.

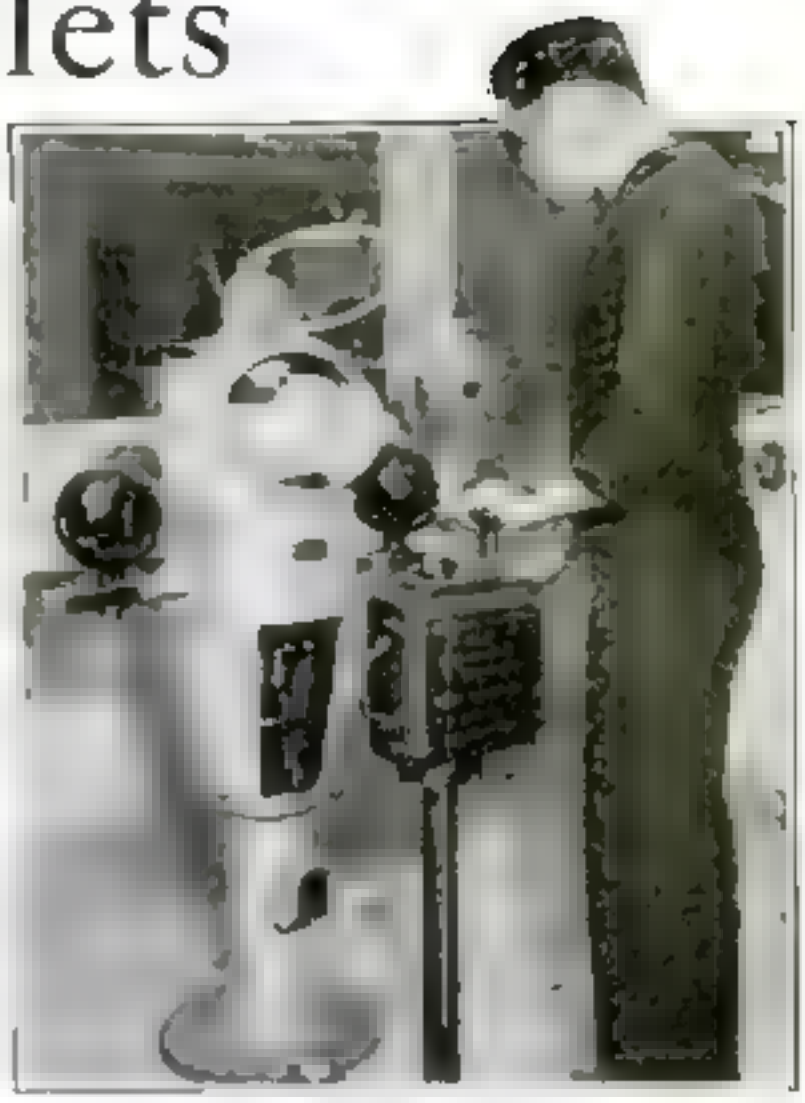
Doctor Gordon worked with rabbits. Those "vaccinated" by sniffing dead virus, he reports, proved immune to cowpox, while others not so protected caught the disease.

Transparent Gold

GOLD of a lacy texture and as transparent as glass, an amazing product announced recently, makes one half believe in magic wands. How it is made is kept secret. A German chemist, Dr Carl Muller, discovered it by chance one day as he was investigating certain chemical rays in his laboratory in Berlin.

The new gold is described as a sieve of crystals through which light plays as through a thin veil of smoke or vapor. It is said to be 50 times as transparent as the thinnest gold leaf hitherto obtainable. Photographs may be taken through it

The webbike structure of the new metal leaves will be of immense value in the study of atomic structure, the discoverer claims, and will lead to a number of innovations in radio, telephone, phonograph, and other appliances that require delicate membranes or conducting surfaces. So little metal is used that real gold may be used for plating instead of gold alloys, making a film that neither fades nor tarnishes.



Electric Tiller to Steer Ships

The most recent improvement over the time-honored steering wheel for ships is this electric controller, which closely resembles those used on streetcars. A slight turn of the control handle by the helmsman causes the rudder to respond instantly to whatever direction is wanted

He Sends Eight Radio Messages at Once

The remarkable achievement of sending eight code messages simultaneously from a single radio transmitting tube, all on the same wave length, and of receiving them all on a single receiving set, was demonstrated recently by John Hays Hammond, Jr. noted inventor. The picture shows him with his staff of assistants at Gloucester Mass., operating the instruments

New Sources of Rubber

"HENRY, we ought to have a rubber source of our own. Foreign governments could clamp down on us any minute, and where would we be?"

"You're right, Harvey. Why couldn't we get hold of some land and produce some rubber ourselves?"

Some such conversation as this may have been the beginning of the huge project announced recently for supplying the United States with rubber. Harvey Firestone has completed arrangements for a 99-year lease on a million acres of land in Liberia, Africa, suitable for rubber production, and a plantation of 2000 acres of fully matured plants. He also took a lease on 35,000 acres of land in Mexico.

Then with his friend Henry Ford he quietly acquired huge tracts of land in the Everglades section of Florida and planted many varieties of rubber trees.

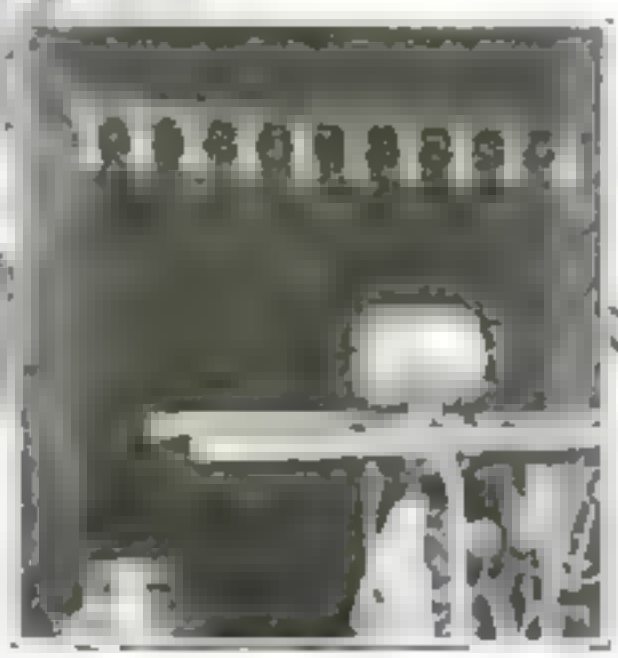
Mechanical Farm Hand Milks Cows

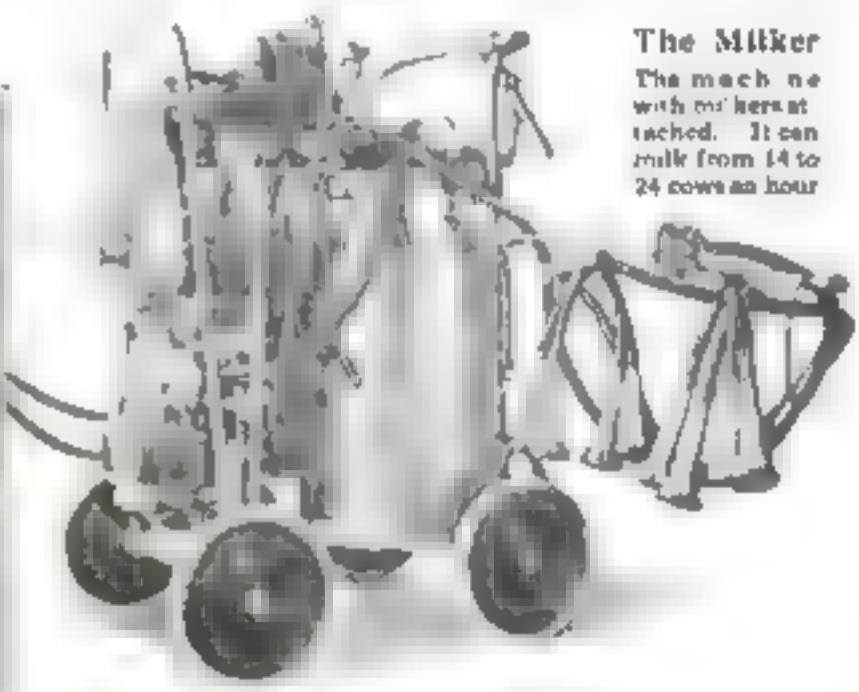
THE cow said to have kicked the lantern in Mrs. O'Leary's barn, starting the great Chicago fire, would have had no such opportunity under the modern milking conditions made possible on the smallest, most isolated farm by Warren A. Shippert, of Dixon, Ill., the inventor of a portable milking machine that not only milks the cows, but electrically lights the barn at the same time. It also does a dozen and one other chores about the farm.

When operated by hand, Shippert's machine can milk one, two, three, or four cows. By means of a partial vacuum it sucks the milk like a calf. It can be taken anywhere on two wheels like a hand truck. To this hand machine add two wheels, power, and power transmission, and it becomes a power machine operated either by a three-fourths horsepower gasoline engine or by an electric motor. It then milks from 14 to 24 cows in one hour

Either arrangement, hand or motor, uses an ordinary shipping can sealed from air and dust. Running a pump exhausts the air in the can. A gage registers the vacuum, a relief valve controls it, and pulsators alternate vacuum and relief

Among other chores, the power machine can be used to run the cream separator, pump water from the well for the stock, churn butter, run the grain grinder, drive the grinding wheel for sharpening tools, run the fanning mill, corn sheller, or sausage grinder. The farmer's wife also can use it as a vacuum cleaner to sweep out the house and to supply power for the electrical household appliances. Even after the day's work is completed it is useful in lighting the living-rooms of the farm and in charging the radio battery overnight.





The Milker

The machine with milkers attached. It can milk from 14 to 24 cows an hour

A Machine of All Work

Above Using the portable power machine to grind tools. Note grinding wheel and attachments driven by belt from motor Right While milking the cows the machine also lights the barn, supplying current for 10 lamps

Paper, Boards, and Boxes from Waste Lumber

NEW uses found for shorts and scraps—the ordinary waste from lumber—promise to save thousands of dollars in the lumber industry Recent experiments in Cloquet, Minn., a little town of forest-fire fame, have found value even in branches and tops of trees—everything down to three inches in thickness. Mills now burning lumber waste under their boilers, it is predicted, soon will look for less valuable fuel

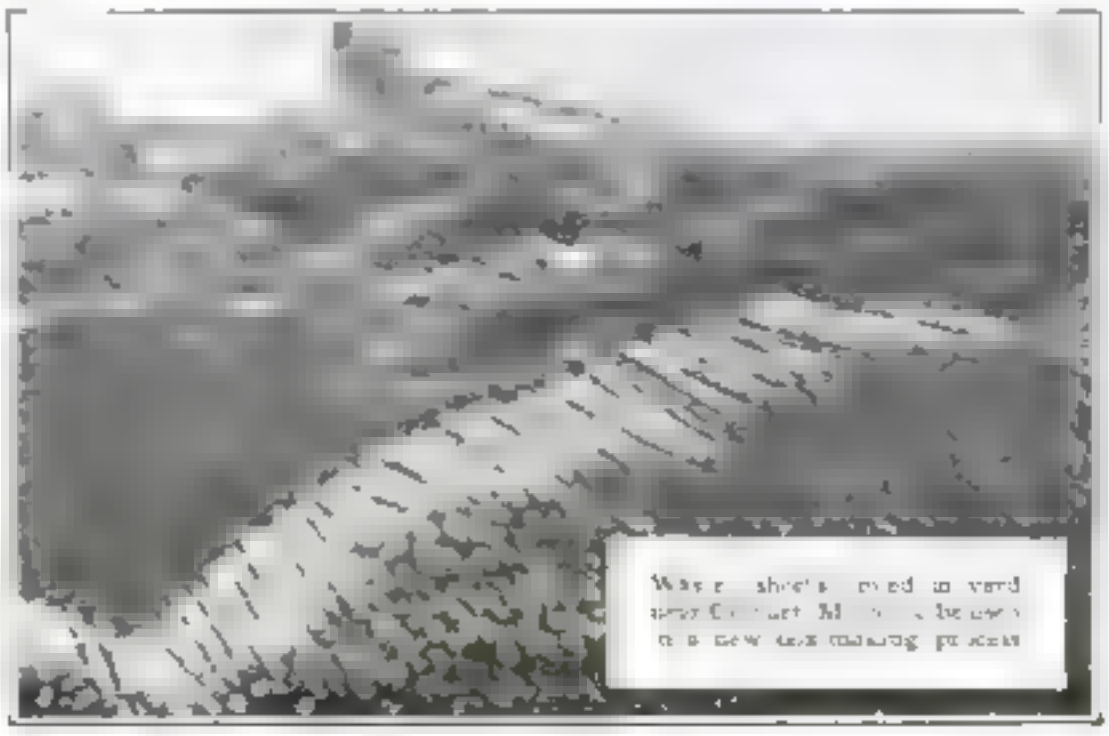
Three new ways have been found to utilize waste formerly considered not worth hauling away from the forests These are the manufacture of a new kind of paper, balsam wool, and artificial boards.

The triumph in paper making was the discovery that poplar and jack pine, thought unsuitable for this purpose, could be used for making bond and other grades of paper. Both kinds of trees have a natural reproduction, and a simple forestry scheme, it is claimed, will insure a perpetual supply of raw material for paper mills.

The leftovers from the paper mill in Cloquet are used to make balsam wool, a new fire-resistant insulating material. It can be applied to houses, icechests, fireless cookers, refrigerator cars, and many other purposes.

When wood fiber is passed through the screen of a paper mill, a certain knotty substance, known as "rough screenings," will not go through. This mass of fiber, when used in the manufacture of balsam wool, is put through a sulphite process, fireproofed and ground It is treated to give it adhesion, and finally is brought out in the form of a sheet of light insulating board

Box factories, having discovered a way to cut tongue and grooves on small boards, now are turning to use many boards of sizes too small for piling in lumber yards, that is, material three inches in width or under, and from 12 to 47 inches in length. The boards are glued together to make boxes. A box factory in Cloquet now is using 11,000,000 feet of such shorts.



Boys Build Scenic Railway of Boards

Three Rides for a Cent—Switches, Too

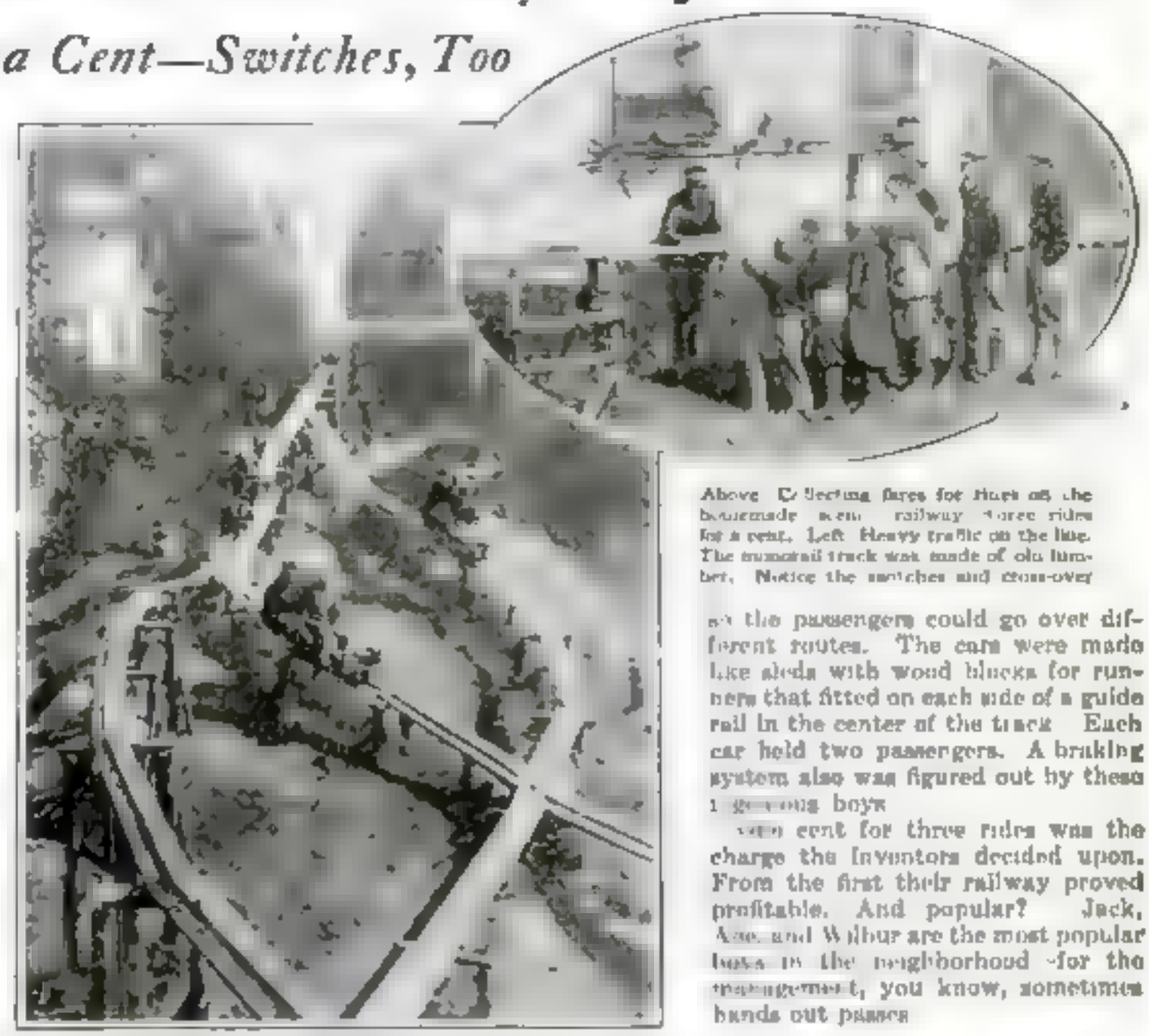
THE Gang was sitting on the steps of Jack Streeter's front porch in Newark, N. J. Summer amusement parks were under discussion. It was a sort of post mortem, for school had begun and trips to the amusement parks would be few and far between. Next summer was ages away

Most of the gang had gone home to supper. Abe Haman and Wilbur Drikson were still at Jack's house when a brilliant idea struck them Why not build a scenic railway? They could even charge for rides. Make money. A real business proposition.

The three formed a closed corporation, so to speak, and operations began. They found a wonderful site—a vacant lot with a slope that would make the cars go lickety-split. There were lumber piles around and with judicious explaining maybe you could get planks for nothing.

The boys put supports in the ground and on these laid a track of boards. They fitted the system with switches so the passengers could go over different routes. The cars were made like sleds with wood blocks for runners that fitted on each side of a guide rail in the center of the track Each car held two passengers. A braking system also was figured out by these ingenious boys

One cent for three rides was the charge the inventors decided upon. From the first their railway proved profitable. And popular? Jack, Abe and Wilbur are the most popular boys in the neighborhood -for the management, you know, sometimes hands out passes



Above: Collecting fares for rides on the homemade scenic railway. Three rides for a cent. Left: Heavy traffic on the line. The monorail track was made of old lumber. Notice the switches and cross-over

Model American Home Is Shipped to France

"HOUSES of painted wood? How strange!" or "No servants? How do you manage?" These are typical remarks of Frenchwomen when American women tell them something of their homes in the United States. Soon they will have a chance to see just what a modern American house looks like

A 10-room house, considered representative of the typical American home, was erected recently in Brooklyn, N. Y. Then it was dismantled completely and placed on a ship with its furnishings and equipment to be taken to France for exhibition in February at the American Section of the International Exhibition of Household Appliances and Labor-Saving Devices.

The two-story shingle house maintains the Colonial atmosphere throughout. The furnishings and decorations are all authentic copies from period pieces. Comfort and livableness in the interior are emphasized. The house is equipped with running hot and cold water, electric lights, gas service, and has every device that modern inventive ingenuity has provided to chase drudgery from the home.

When they all see the rebuilt home, Frenchwomen will be astonished by the amount of household work that can be done by pressing a button. For vacuum cleaners, washing machines, drying machines, electric irons, cookers, and refrigerators are unknown to most Frenchwomen.

After the International Exhibition is closed the American Home is to be given to the French citizen who has made the greatest contribution to humanity in recent years.

Maxime Mongendre, French Consul General in New York (left), receiving from Arthur Williams, Vice-President of the New York Edison Company, the keys to the Model American home

The model 10-room house as it appeared in Brooklyn, N. Y., before shipment to the Paris International Exhibition. It is of the Colonial style and is fitted with all the most modern electrical appliances, conveniences, and comforts

Auto Carries Wire Cutter to Foil Bandits

A German motor car with the sawlike wire-cutting attachment

A WIRE is stretched across a lonely country road. The car must stop. Highwaymen leap from the brush on either side, and another hold-up is perpetrated.

So frequent has become the use of wires in robberies in Germany that a novel sawlike wire cutter has been devised. Attached to the front of an automobile, it is said to be successful in cutting the strongest strand.

New Gas Manufactured

MANUFACTURED gas that is said to give twice the heat and light value of any gas now used, was announced recently by Col. E. E. Garrison, president of a New York gas company. It is made by vaporizing the heaviest oils obtainable, including sludge and tar, in a column of superheated steam. It can be produced, it is claimed, at much lower cost than any gas manufactured today.

Know Your Car

THE spark plugs in your automobile have but one function—they provide a small gap between two metal surfaces or wires so that the high voltage current generated in the spark coil may jump the gap and, in so doing, heat the gasoline and air mixture so that it will ignite. One of the wires forming the gap must be insulated completely, otherwise the current would take an easier path than that across the gap.

To keep your spark plugs on the job, follow these rules:

1. Be careful not to strike the plugs with a wrench when you are working on the engine. A slight jar may start a crack in the porcelain that will, later on, short circuit the plug.

2. Never screw a cold plug tightly into a hot engine. Wait till the plug has become warm before you give it the final twist with the wrench. Otherwise the plug may set so tightly that you will have trouble getting it out.

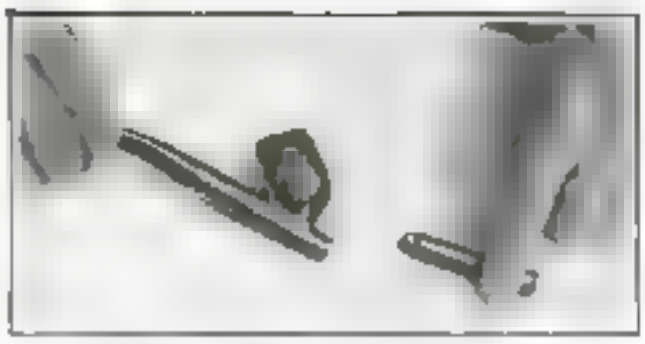
3. Always clean your plugs when the porcelain core begins to show black from carbon deposits.

4. Never use a sharp knife to scrape off the carbon. You may scratch through the glazed surface of the porcelain and the rough places will collect carbon very rapidly.

5. See that the gap is set about the thickness of a worn dime.

Electric Shears Sharpener

DRIVEN by a small electric motor, this new sharpening machine for barber shops will, it is claimed, sharpen a pair of shears in one minute. An adjustable gage holds the edge of the shears against a convex carborundum wheel at the part of the wheel that will assure the correct bevel.



Curious Pipe Devised for a Clean, Sweet Smoke

FROM the land of pipes comes another ingenious idea to keep your smoke clean and cool. A British inventor has made a new pipe with a trap for nicotine. The pipe stem is elongated, running past the bottom of the bowl. Fitting to this is a small metal tube perforated at the bottom and covered with a wooden tube.

A tubular chamber screws into the bottom of the wooden tube and into this chamber flows all the nicotine and saliva. Because it is kept so far away from the pipe bowl, the nicotine, it is claimed, cannot be drawn into the mouth, for it would have to traverse the length of the small metal tube and be drawn through the small perforations.

A Keyboard for Kettle Drums Plays Eight of Them

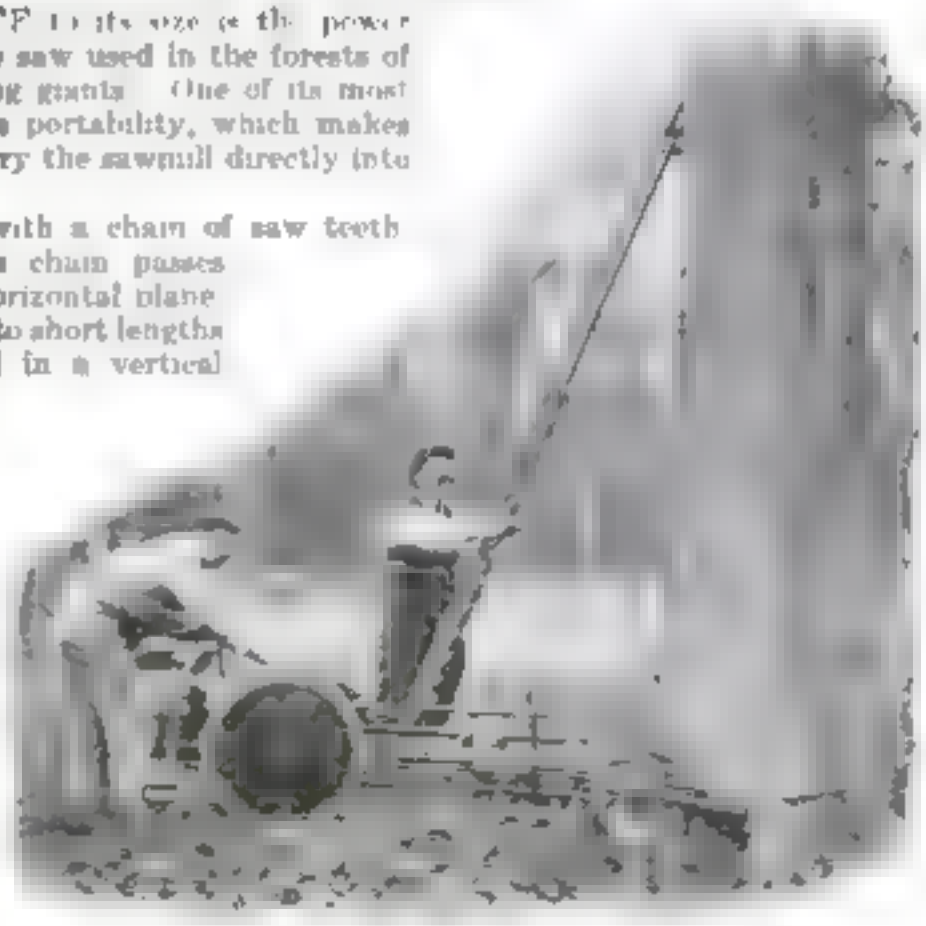
IN SPITE of his amazing dexterity, the kettle-drum player in an orchestra needs even more agility to play all that is demanded of him in modern music scores. Professor Schneller, a noted kettle-drum player of the Vienna Philharmonic Orchestra, is coming to his rescue with a kettle-drum piano that will operate eight drums of varying pitch.

Even the most modern orchestras have at most four kettle drums. With a piano keyboard arrangement, the work of the drummer, it is claimed, would be lessened greatly. But would not the admiration of the audience also disappear?

Taking a Sawmill into the Forest

DISPROPORTIONATE to its size is the power of this unique plane saw used in the forests of France to topple towering giants. One of its most interesting features is its portability, which makes it possible literally to carry the sawmill directly into the forest.

The cutting is done with a chain of saw teeth. When felling trees, this chain passes around the trunk in a horizontal plane. For cutting the trunks into short lengths later, the chain is used in a vertical plane. A small motor runs the saw. The chain is made up of separate links, so that if damaged, a section of the chain could be removed quickly and replaced.



Felling a tree by motor power with the portable plane saw

VACCINATING for rheumatism is announced from Vienna, Austria, where Dr. Gustav Paul, director of the National Vaccination Institute, claims positive cures in 600 cases.

Newest Powder Puff Can Be Cleaned Easily

YOU use a spoon to fill this new powder puff Once filled, the slot through which the powder has been poured is closed so that the puff will not leak.

When the puff is patted, the powder comes out of small perforations in the wool. The chief advantage claimed for this beauty aid, besides being a powder container, is that it has a back of rubber and the wool powdering surface may be washed very easily.

Pests Invade Pine Forests

IN THE last few years tens of thousands of American trees—enough to build thousands of homes—have been destroyed through the invasion of the great Pacific forests by the pine beetle, an insect that in less than one year can ruin the mightiest pine tree.

Evidence recently submitted to the U S Senate Committee on Public Lands showed that in a single section of 1,000,000 acres in Klamath County, Ore., lumber destroyed by the pests would have been enough to build not less than 8000 American residences of an average cost of $12,500 each

White Traffic Lines Made with Porcelain Studs

A NEW idea for making permanent white lines for use at street crossings and for the direction of motor traffic is to be tried out soon in London. White porcelain studs are inserted in holes drilled in wood paving

The studs are inserted in a line three abreast, making a strip of white wide enough to be seen easily. The chief advantage of the porcelain is that it is unaffected by weather, oil, or mud, and thus makes a line that cannot be erased by the constant beat of traffic

How the porcelain studs are inserted

Huge "Vacuum Cleaner" Now Unloads Cargoes

FROM the South Sea Islands every year hundreds of tons of copra—dried meat of cocoanuts—are unloaded at the San Francisco docks. A giant "vacuum cleaner," recently installed, now does the work of unloading, taking the place of a crew of 25 laborers.

It unloads from 30 to 40 tons an hour. With it three men can do the entire job.

Using a vacuum machine to unload a cargo of copra

Six Pocket Tools Combined in This Cigar Cutter

ONE more curve, one more use. Inventors get real fun out of figuring how, with a few extra edges and odd projections they can give a bit of metal a large number of uses.

The device illustrated above is a six-in-one pocket tool. In the photograph it is being used as a cigar cutter, but it is equally effective, it is claimed, as a bottle opener, screwdriver caliper, wire cutter, or key ring.

Metallic Substitute for Diamond

AFTER several years of research, metallurgical experts of a steel plant at Wetzlar, in southern Germany, claim to have produced a metal alloy nearly as hard as the diamond. The difference in the scale of hardness is merely one-tenth of a degree. The alloy consists of a fused mixture of metallic tungsten and tungsten carbides.

Tests have shown that this tungsten alloy, while somewhat softer than diamond, offers many practical advantages. It is said to have metallic structure and to retain its cutting power much longer than the diamond that has crystalline structure and is extremely brittle, hence soon loses its cutting power by the chipping of its crystal edges.

Criminals Change Their Faces by Plastic Surgery

THROUGH the clever capture in Vermont of a burglar who had his facial appearance altered by surgery, attention was called recently to the increasing use of plastic surgery by criminals seeking to escape identification. On the prisoner was found a receipt for $460 paid to a New York surgeon for changing the contours of his ears, chin, and nose. He had dyed his hair, too.

How Much Do YOU Know about Science?

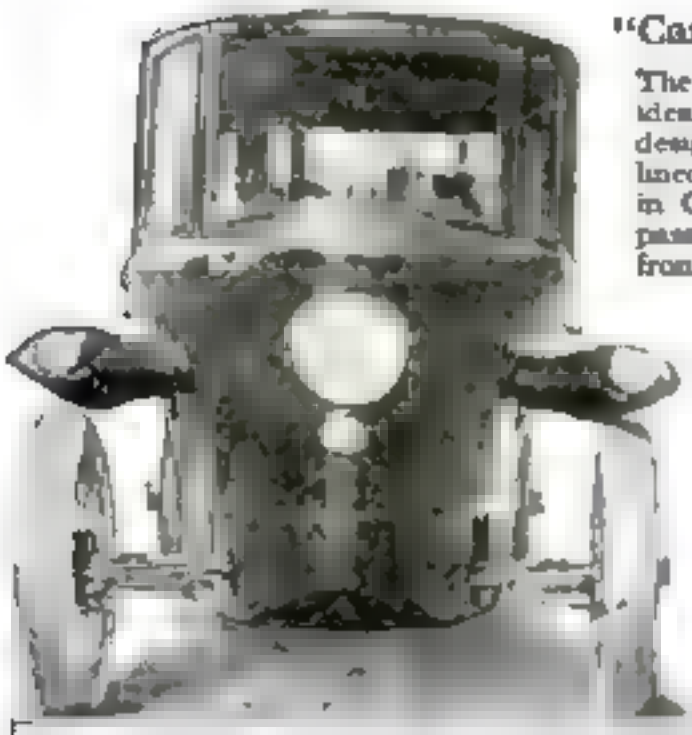
THE following 12 questions were selected from hundreds of queries that come from POPULAR SCIENCE MONTHLY readers every month. Read them over and see how many of them you can answer. Although the questions have to do with things that we encounter every day, they involve a surprising number of new and interesting facts about the world we live in.

Here's a chance to test your knowledge. After you have answered the questions to the best of your ability, turn to page 150 and see how nearly you were right.

1. When do children grow fastest?
2. Why do onions make our eyes water?
3. How were precious stones formed in the earth?
4. Why does a gun make a bang when it goes off?
5. What is the carrier wave?
6. Why does frost kill a plant?
7. What is dynamite made of?
8. Why do cats ruffle their hair?
9. Is there any place where things weigh nothing?
10. Why does the earth revolve?
11. What was the first animal to live on dry land?
12. Why is it difficult to walk in a straight line when your eyes are closed?

Oddities *on* Wheels

Some Remarkable Developments in Light Cars and Heavy Buses

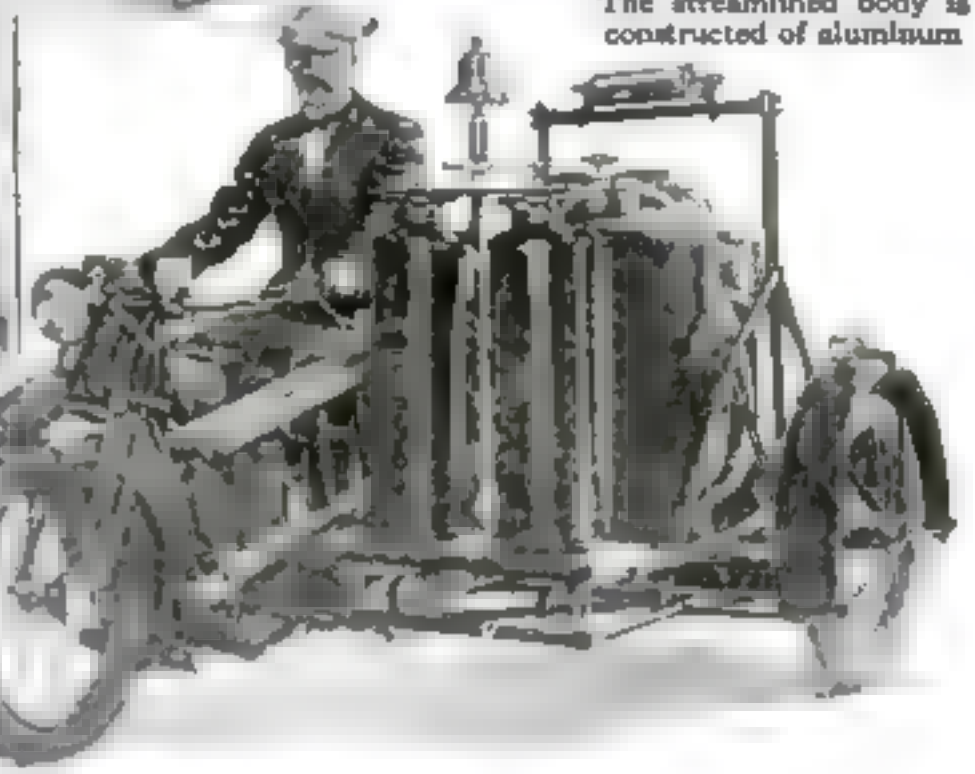


"Cart before the Horse"

The "cart before the horse" idea has been applied in the design of a novel streamlined passenger car developed in Germany. Seats for the passengers are placed in front, while the engine is carried at the rear as shown in the side view below. The boatlike body has a sharply pointed prow, pictured at left, to cut the wind

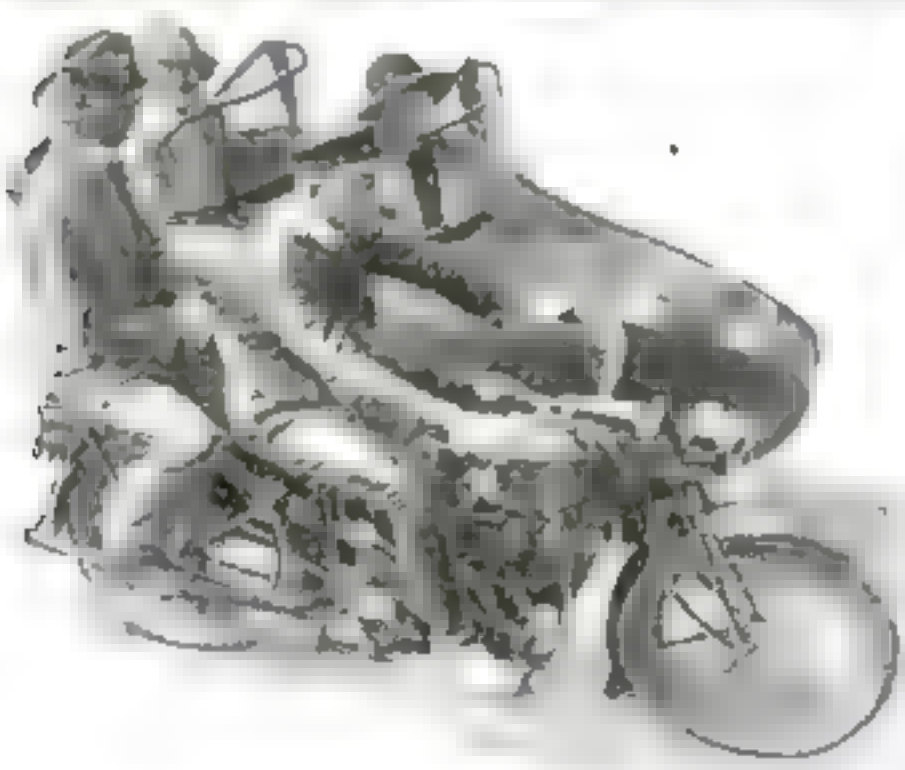
Tricycle for Two

For the young couple not too particular about comfort, there recently has been developed this light three-wheeled cycle car. The streamlined body is constructed of aluminum



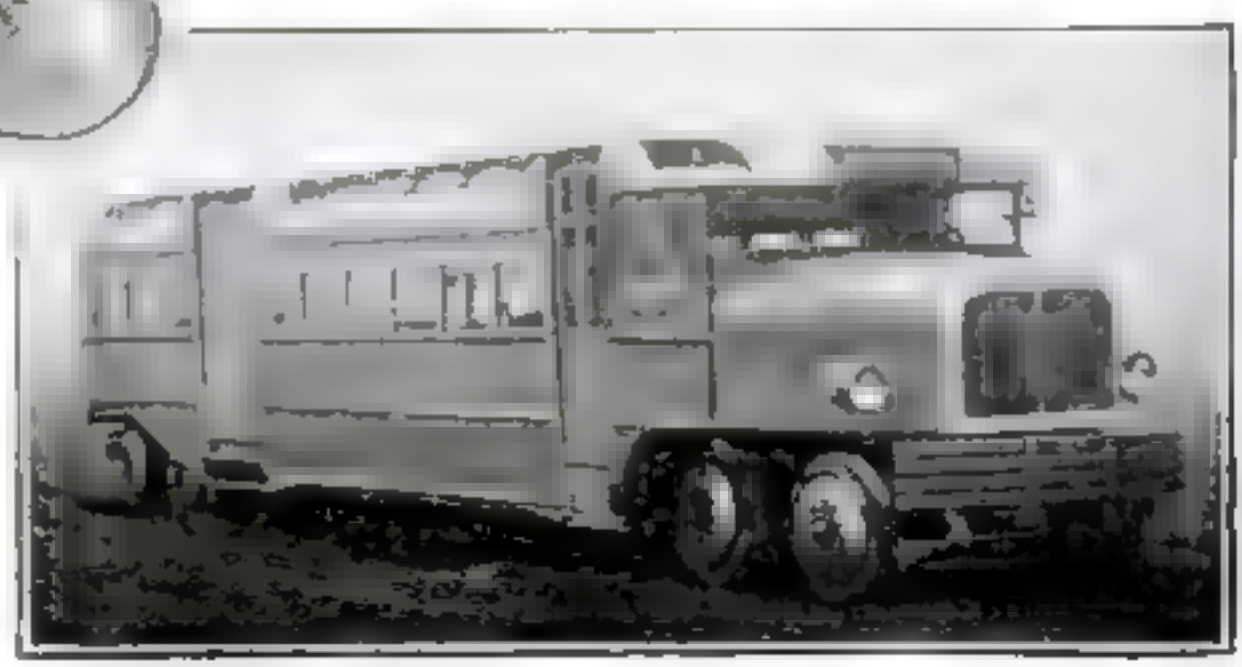
Fire Apparatus Carried on Sidecar

A sidecar fire engine carrying complete fire fighting equipment was a novel exhibit at a recent motorcycle show in London. This compact apparatus was designed for use in rural districts and for fighting forest fires. The equipment includes chemical extinguishers and a pump



Two in Sidecar Tandem

This four-passenger motorcycle carries two in the sidecar. Each of the sidecar seats is fitted with a windshield and separate door for entry. The car is streamlined, as illustrated

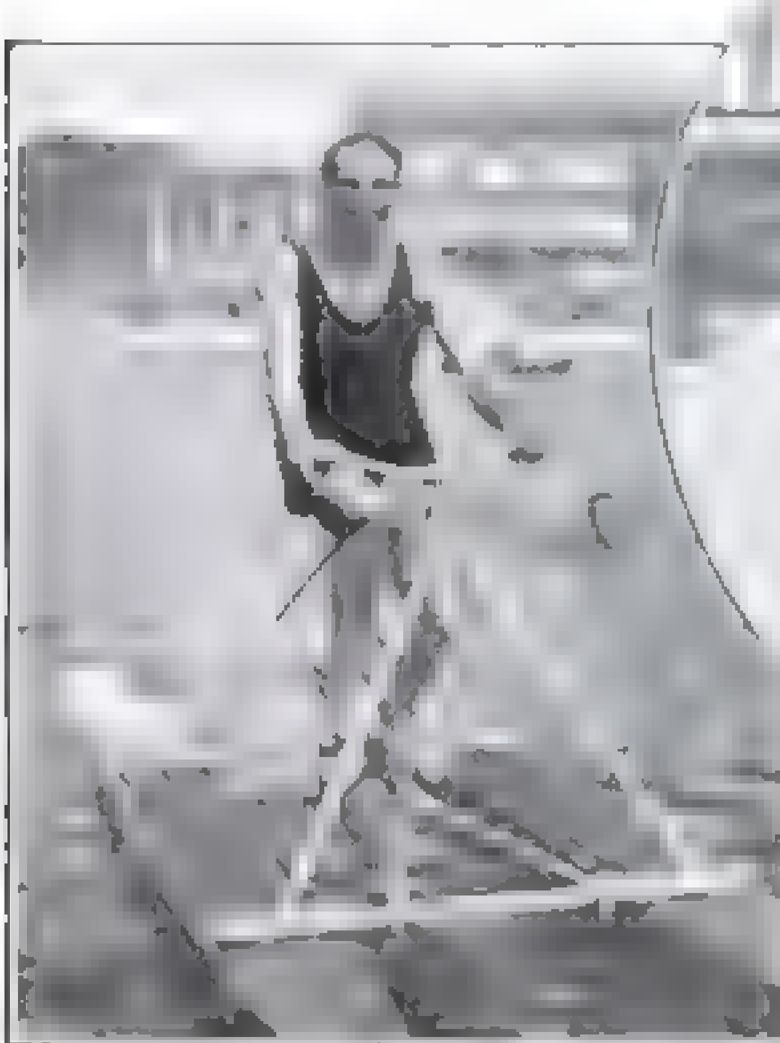


Eight-Wheel Passenger Bus

A recent remarkable development in overland passenger buses is the huge eight-wheel gas-electric coach pictured at right. It is driven by a 110-horsepower engine with electric transmission. An ingenious steering mechanism makes it possible for the huge vehicle, 36 feet long, to turn around almost in its length

Queer Boats *and* Their Skippers

A Sea-Going Bicycle—Novel Man-Driven Propellers—A Powerful Hydro-Glider



No oars needed in this boat. That's why James Marv[illegible] of Wa[illegible], Mass., built it. M[illegible] [illegible] the [illegible] [illegible] [illegible] the [illegible] [illegible] the boat [illegible] [illegible] [illegible]

A Water Bike

Antonio Moreno, movie star, was making a picture on the Riviera, when he became interested in a new sport called "water cycling." The photograph shows him riding the novel machine, a bicycle frame mounted on two pontoons. The pedals drive a paddle wheel at the stern

Stormy Trip in 20-Foot Boats

Frank J. Coyle and Fred S. Dale, engineers, left New York for Florida a short time ago in 20-foot [illegible] boats, the smallest craft ever to undertake such a voyage. Each boat was equipped with oars and a sail. In their venture, Coyle and Dale undertook a feat that many believed to be impossible in the winter

Hydro-Glider Built for Belgian Congo

Built especially for the shallow waters of equatorial Africa, this compact hydro-glider can carry freight and six passengers at a speed of 20 miles an hour. Driven by a 200-horsepower motor, it furnishes striking contrast to the various types of primitive native craft it passes every day

Canoe Propelled by Feet

In Birmingham, England, T. Allen, an engineer, designed this bicycle canoe. The operator lies at the back and pedals. Allen is shown taking his wife on a trial trip

Paris Tries Moving Sidewalks

LIKE all the great cities of the world, Paris is faced with the problem of traffic congestion in its chief thoroughfares. Not long ago a test was made of elevated moving sidewalks and now the city fathers have decided to install them at busy street crossings

The sidewalk is wide enough to accommodate only one person. It is corrugated, somewhat as an escalator is, to avoid pedestrians' slipping in wet or in freezing weather

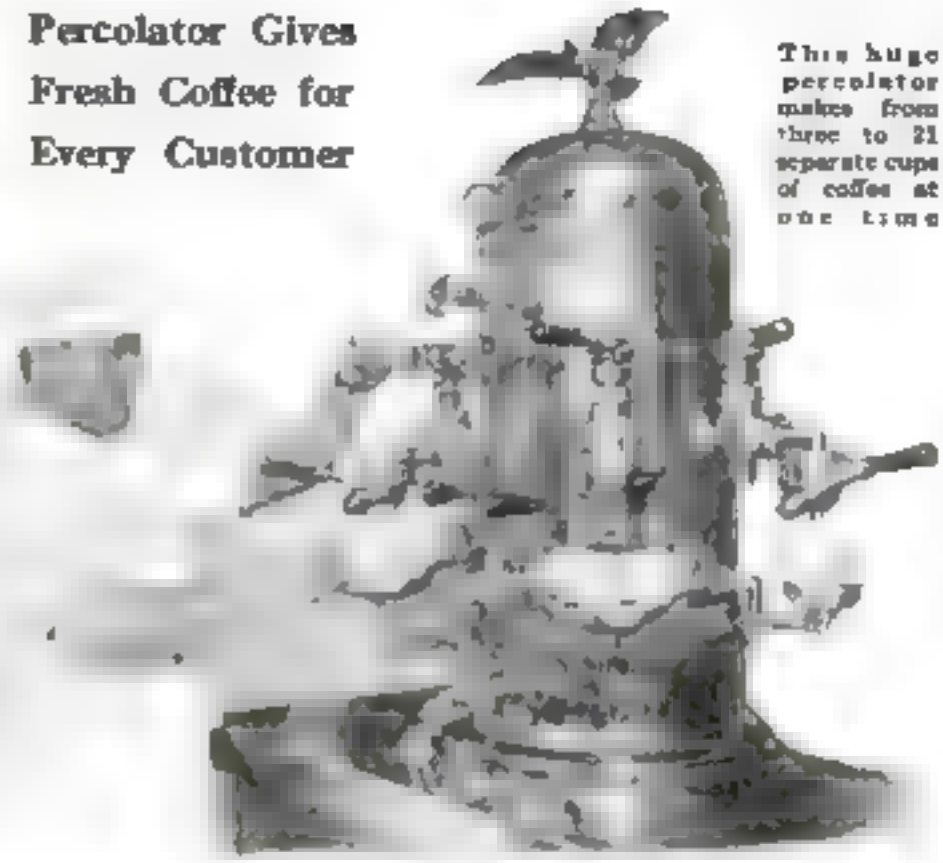
Electric Groover Aids when Installing Weather Strip

A NEW portable electric tool for cutting grooves in wood was designed especially for installing metal weather strips. Only two adjustments are necessary, one for the depth and the other for the location of the groove, after which guides keep the tool in position.

The motor will operate on either alternating or direct current and may be attached to an ordinary electric-light socket. There is a switch in the tool's handle so that the current can be turned on or off without its being necessary for the operator to change his grip.

AN ITALIAN zoologist, Dr. Filippo Silvestri, went to the Orient in search of parasites to combat the Oriental red scale that has ravaged the orange-groves of California. He discovered three kinds of insects that feed upon the pest, and is shipping them here by the thousand.

Percolator Gives Fresh Coffee for Every Customer



This huge percolator makes from three to 21 separate cups of coffee at one time

"CHIEF engineer" would seem a more appropriate title than "chef" for the man who operates the intricate looking piece of machinery illustrated. But it is only a coffee percolator of the latest model for restaurant use and, in spite of its many levers and attachments, it is said to be very simple in operation.

It makes from three to 21 cups of coffee at a time, each order made separately. Warmed-over coffee has no place in the up-to-date restaurant.

How logs are set in the concrete to form an inside ring wall, which is then stuccoed on the outside

House of Logs and Concrete

A CLEVER builder in St. Paul, Minn., takes advantage of the shrinking property of green wood to build warm, air-insulated houses. Wood logs cut in pieces as long as the wall is to be thick, are laid in the concrete while green. The wall is stuccoed on the outside, while the inside is furred and lathed

The wood dries out, leaving air spaces that, besides insulating the house against heat and cold, act as a sound deadener. Where wood is plentiful, this method costs little.

Motion-Picture Outfit Weighs only Five Pounds

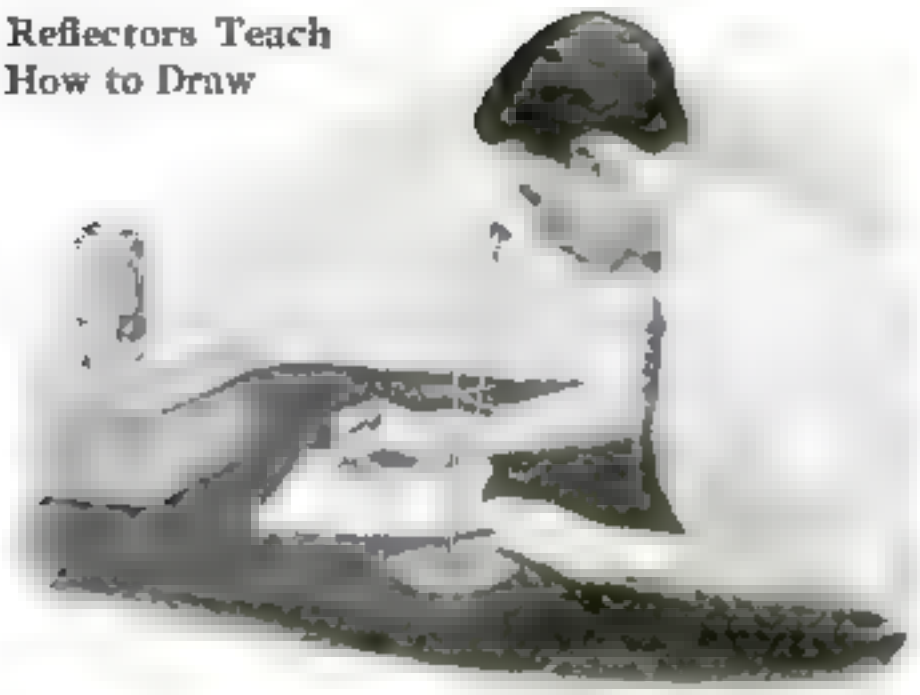
MANY American travelers abroad last summer brought back with them surprising little motion-picture outfits made in France for amateur photographers. Now these machines are on the market in the United States.

The camera and projector are small enough to be carried in a small handbag, the combined weight of both machines being only about five pounds. Close-ups of objects in motion can be made at five feet, and pictures may be taken at any distance without any focus adjustment.

Pictures can be projected on as small an area as the human hand, it is claimed, with perfect visibility. An especially ingenious feature of the projector is an automatic stop that halts the movement of the film while subtitles are being shown. This effects a saving in film footage.

Left: Taking a picture with tiny camera. Right: Projector is very easy to operate

Reflectors Teach How to Draw



CORRECT proportion, perspective, and all the other hoodoos of the would-be artist are conquered, it is claimed, by an ingenious little assistant with double mirrors. The artist looks through the reflector and follows with pencil, pen, or brush what he sees on the paper

By adjusting the position of the reflector the size of the finished drawing may be determined—exact size of the original, enlarged, or reduced. The instrument may be used, also, to teach penmanship. By following what he sees reflected on the paper, a child learns the proper formation of letters.

Now You Can Call up Your Friends at Sea

"HELLO, when did you leave New York? Saturday? That's the day we sailed from Hamburg. From our positions on the ship chart today, I noticed that your boat and ours are just 100 miles apart."

A scrap of conversation on board the new German liner *Berlin*, the first ship to be equipped with radio-telephone booths for the use of passengers. They are connected with the ship's radio room, where the sending and receiving apparatus is located, and are operated through a switchboard

With this radio telephone you can talk to friends on other ships within a radius of a few hundred miles.

Phoning from an ocean liner

Ceiling drill is supported by tubing

Atop an 85-Foot Fire Ladder

TO ILLUSTRATE spectacularly what could be done with a new 85-foot fire-fighting aerial ladder, it was raised to stand erect, with the fly ladder fully extended. On the extension, towering high above the truck, a nervy man climbed to the top, while the apparatus remained firm, absorbing the strain within itself.

The ladder is raised automatically and is operated on a turntable, which revolves in any direction. A screw-operated friction brake locks the turntable at any point.

Styles in Industrial Gas Masks

BECOMING? Far from it. But the young women were willing to hide their faces for a few minutes in order to demonstrate the latest models in respiratory masks.

The one on the left and that in the center are dust masks for use by persons working with emery wheels and in factories where fine powder flies in the air. They are alike, except that one has a goggle attachment. The one on the right is a gas mask used in places where work is done with acids.

Drill for Making Overhead Holes in Concrete Buildings

AS THE use of concrete in building grows the problem of how to drill overhead holes economically has arisen. Thousands of such holes must be drilled to hang shafting, strap electric conduit, run sprinkler lines, and fasten partitions.

A new device recently put on the market, illustrated at the left, enables an electric or pneumatic drill operated by a single workman to be used for this awkward work. The drill is clamped firmly to the upper end of a shaft made of two telescopic pieces of steel tubing. Handles controlling the drill are placed at a convenient working height on the tubing. Power control is provided by running a draw wire from the trigger switch to the handle position and a coilspring provides the pressure needed to make the drill bite in.

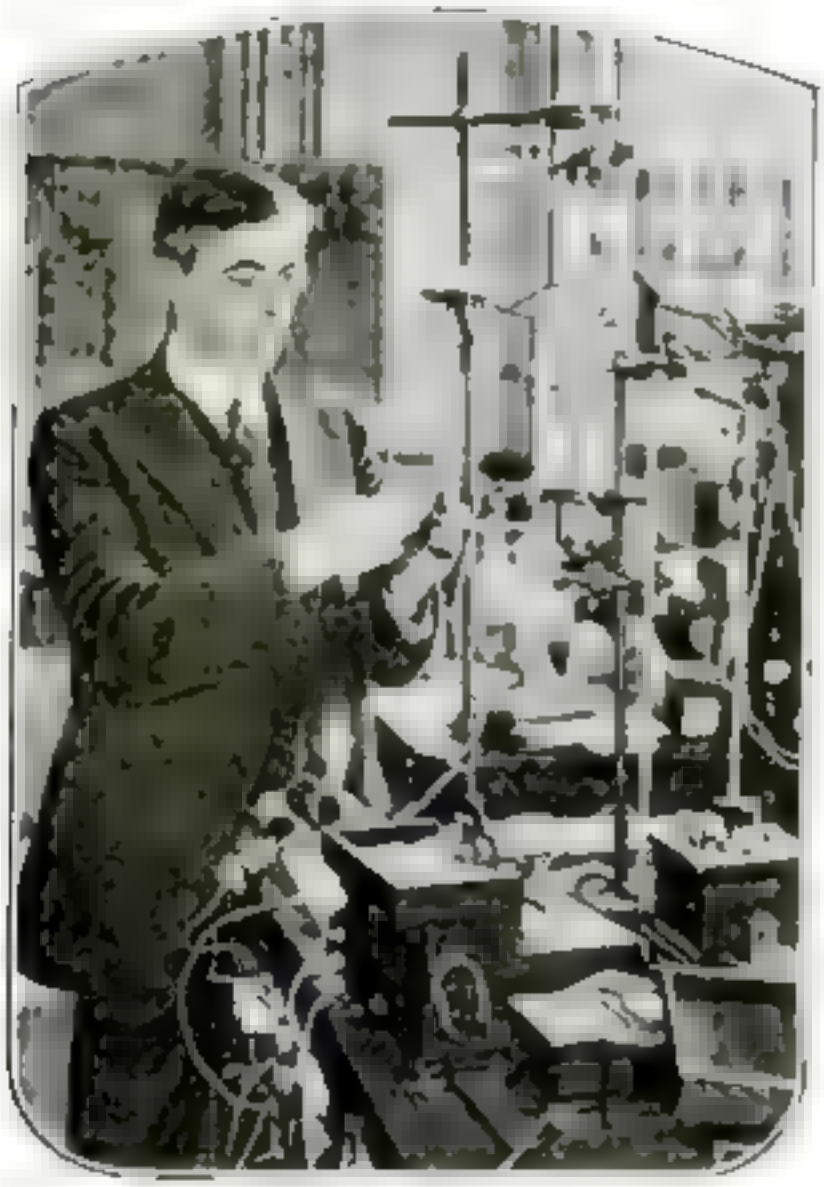
Newest Micrometer Gives Its User a Direct Reading

NO MORE squinting at the fine graduation lines of a micrometer for the machinist making careful measurements. This micrometer is claimed to give readings of thousandths of an inch, in clear figures. Furthermore, it is of a size that can be held and operated easily in one hand. The makers say that the dials cannot get out of order.

Micrometer gives its own clear reading

How Science *Is* Putting *New*

A Hunt for the Birthplace of Storms —Marvelous Vacuum Tubes—Inventions that Meet Our Needs



Wins Basic Patent on Vacuum Tube

Dr. Irving Langmuir, Assistant Director of the General Electric Research Laboratory. For his invention of the hard type of vacuum tube used extensively for radio and X-ray his company has just been awarded a basic patent after a legal battle lasting a dozen years. It is estimated that more than 10,000,000 tubes embodying his invention are at present in operation throughout the United States

The lure of a new discovery lies in its possibilities for useful applications. So it is that the developments of scientific progress, told in concise form on these pages, bear vitally on the happiness, comfort, and success of every man. To read about them will help you to keep well informed of the world's achievements.

A New Slant on the Weather

"THE birthplace of storms"—that vast frozen sheet covering Greenland's icy mountains—is the ultimate goal of an expedition of adventurers that is being organized this winter under the leadership of Prof. W. H. Hobbs of the University of Michigan, an authority on glaciers and geology.

The party expects to start for Greenland next July, equipped with airplanes for preliminary exploration, with radio apparatus to maintain communication with the outside world, and with scientific apparatus to record pranks of the weather and to observe the movements of the great Greenland glaciers.

One of the chief objects of the expedition will be the establishment of a weather observing station on the vast plateau of ice some 150 miles inland and 7000 feet above sea level. Never before has this been accomplished. At this station Professor Hobbs hopes to maintain a staff of observers for a year to give meteorologists of the world the first accurate information concerning weather disturbances in the part of the world where severe storms are believed to gather. The observations, sent by radio to civilization, are expected to aid greatly in making accurate daily weather forecasts in the United States and Canada.

While the expedition will be under the auspices of the University of Michigan, several American governmental bureaus interested in scientific problems of the arctic regions have promised to take part.

A Marvelous Tube

A TUBE so sensitive that it rings a bell when a ring of cigarette smoke floats by, that shrieks a warning when the shadow of a burglar crosses its surface, that measures the light of stars millions of miles away—such a marvelous instrument was exhibited recently by V. K. Zworkin, a physicist in the Westinghouse Electrical Research Laboratories.

It is a combination of a thermionic tube, one that responds to heat, and a photo-electric cell, which turns light into electricity. The tube looks about the same as an ordinary vacuum tube, but reacts to variations of light falling on it, these variations being converted into surges of electricity that can be converted into sound. The sounds are amplified a thousand times.

The day when we shall have radio movies is brought much closer, it is claimed, by this unique invention, which is pictured on the opposite page. Other possible uses are in the automatic control of railroad trains and ships.

Noted Inventor Rewarded

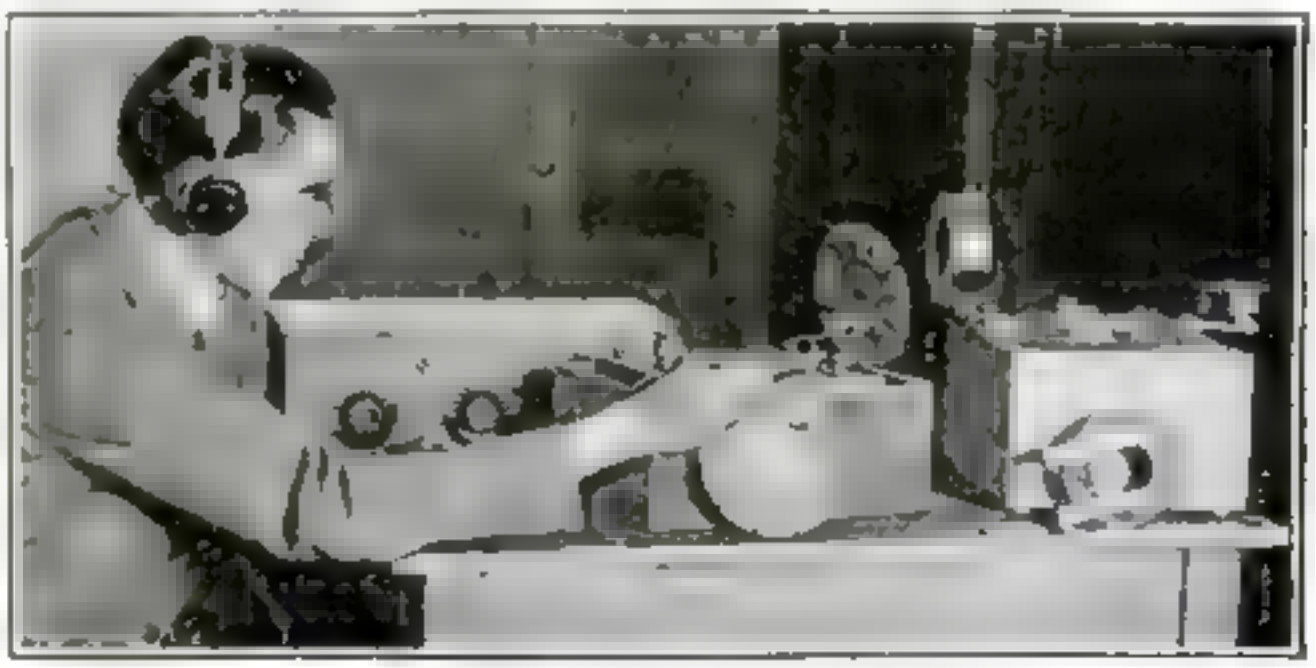
CLOSING a 12 years' legal battle, the United States Patent Office recently awarded the General Electric Company the basic patent rights of the so-called hard type of vacuum tube, used for radio and X-ray purposes. The tube was invented in 1912 by Dr. Irving Langmuir, assistant director of the General Electric Research Laboratory, but because of contests the patent was not granted until this year.

It is estimated that more than 10,000,000 tubes embodying the invention are in operation in the United States.

The tube is characterized by its hard, constant vacuum and its general reliability, permitting its manufacture in large sizes operating with more than 60,000 volts, as well as in small sizes such as are employed in the ordinary home radio receiving sets. Prior to this invention, all radio and X-ray tubes were of the type known as "soft." They glowed and acted erratically except on low voltages.

Tasteless Cod Liver Oil

HAVE you any disagreeable recollections of cod liver oil? If so, you will agree in calling Drs. Harry E. Dubin and Casimir Funk, biochemists of New York, real benefactors. They claim to have removed its bad taste.



Checking Up on the Broadcasting Stations

With about 500 broadcasting stations crowding the ether, it has become increasingly important that each station shall keep exactly on the wave length assigned to it by Uncle Sam. To check and measure the frequencies of distant stations, Morris S. Strock (above) of the Radio Laboratory, Bureau of Standards, has perfected this ingenious instrument—a sort of radio detective

Ideas *to* Use

It was only comparatively recently that scientists discovered why cod liver oil was good for babies. It is the richest source known of two vitamines, one that prevents rickets in children and another that wards off a serious eye disease that often results in blindness. After this discovery, efforts were begun to make an extract of the oil that would be easy to take

Not only is the nauseous taste removed in the new extract, it is said, but it contains, in a given quantity, several thousand times as many vitamines as the original oil

New Tunnel for Niagara

THE old Beddell stairway leading down past the "Rock of Ages" and into the Cave of the Winds at Niagara Falls is to be abandoned. A new subterranean passage 200 feet long has been bored through the great cliff over which the falls roars connecting with a shaft sunk straight down from the surface of Goat Island.

At the mouth of the shaft is a peninsula named "Clearwater View," which affords a marvelous close-up view of the falls.

An Improved Headlight

FOR a long time the laboratories of the Westinghouse Electric and Manufacturing Company have been trying to find a good metal reflector for use in automobile headlights. What they sought was a reflecting material that could be cleaned with gritty waste without scratching, and be exposed to the weather without tarnishing or corroding.

Robert J. Piersol, research chemist, announced recently that it had been found. The new reflector has a surface of polished chromium, which is extremely hard. A popular reflector for automobile headlights has been silver or nickel plating on a smooth surface, but silver must be coated thickly with lacquer to protect it from the weather, while the reflecting qualities of nickel are not high. Chromium, it is claimed, has neither of these disadvantages.

Hunting Pygmies In Panay

Amazing Tube Responds to Light

V. K. Zworkin of the Westinghouse Electrical Research Laboratories, with his amazing new thermionic photo-electric tube designed to convert the power of light into electrical impulses. Physicists declare that the tube marks an important step forward in radio transmission of pictures, for it will send on electrical impulses whenever light falls on it

Simple Test for Pearls

IN PARIS not long ago a group of the world's greatest pearl merchants watched a French scientist pour gently a handful of pearls into a tube containing what appeared to be water. Some sank to the bottom, but others floated

"Gentlemen," the scientist said, "you will find that the pearls light enough to float in this fluid are natural pearls. Those that sank are cultivated Japanese pearls."

Thus he announced a discovery of great interest to jewel merchants and owners. Hitherto, Japanese pearls, those made by oysters when a pebble or other foreign body is put in their shells, could be distinguished from natural pearls only by a complicated X-ray examination. The test with the mysterious fluid can be performed by an amateur.

He Weighs Human Brains

Doctor Arthur MacDonald, well known government psychiatrist, is shown here demonstrating on a fellow scientist how he estimates the weights of a brain of a living person by certain measurements. Given the brain weight Dr MacDonald claims he can analyse the mental capacity of any type of individual

Matches Made Waterproof

"NOTHING but soaked matches. We'll have to dry them out before we can have a fire."

This calamity, avoided by the experienced camper or woodsman, who packs his matches carefully in waterproof cases, is often suffered by the amateur. Now Morland M. Deasau has come to their rescue with waterproof matches. They can be dropped into water without spoiling them, he claims.

The heads are made of rubber latex mixed with the explosive material, the whole then being vulcanised.

Can We Use Vegetable Fuel?

POWER from potatoes is Henry Ford's solution for the world's worry about fuel in the future. We can grow our fuel, he said in a recent interview, and convert it into electric energy to heat our cities.

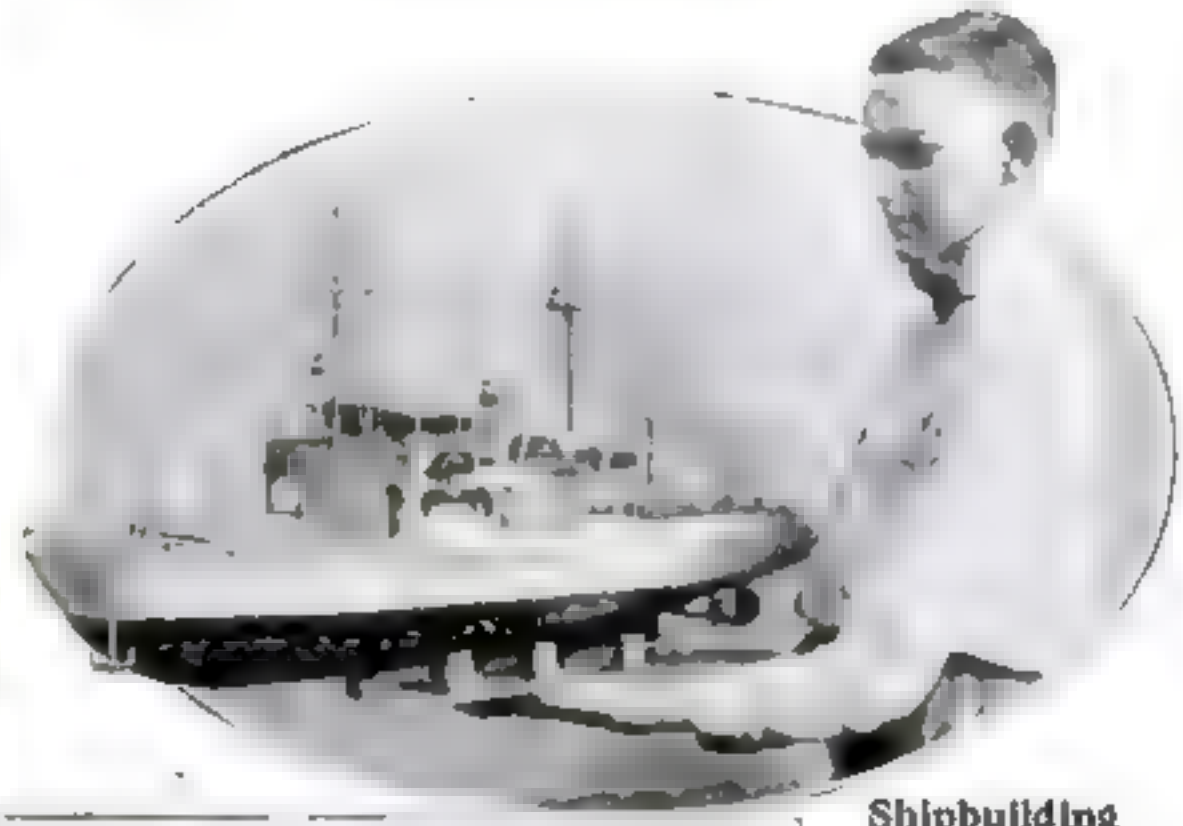
Sawdust, apples, weeds—every bit of vegetable matter that can be fermented contains potential fuel. An acre of potatoes in one year will produce enough alcohol to drive the machinery necessary to cultivate the field for a hundred years, Ford declares.

Among other things, Ford predicts that eventually coal would be burned underground at the mine and sent to consumers in the form of heat and power without ever bringing it to the surface

Unusual Products of Handicraft

Making Animals to Order

A firm in New York City makes mechanical men and animals—anything from a tiny mouse with every joint articulated, to the largest jungle beasts. The picture above shows how an elephant's trunk is built to move like a real one



Shipbuilding in Paper

Two thousand pieces of paper were used by painstaking young Thomas Northrop, a resident of the Panama Canal Zone, in making this amazingly accurate model of a ship

A New Type Submarine

A young Polish engineer, Alfons S. Kiebzaki, designed the submarine pictured above. Instead of the usual framework, its inner shell is composed of 56 cylindrical sections held together by iron rods

Model of California's Capitol

With a penknife, wood file, hammer, and his hands, John Maguekia, while a patient in a sanitarium at Weimar, Calif., fashioned this beautiful little model of California's state Capitol

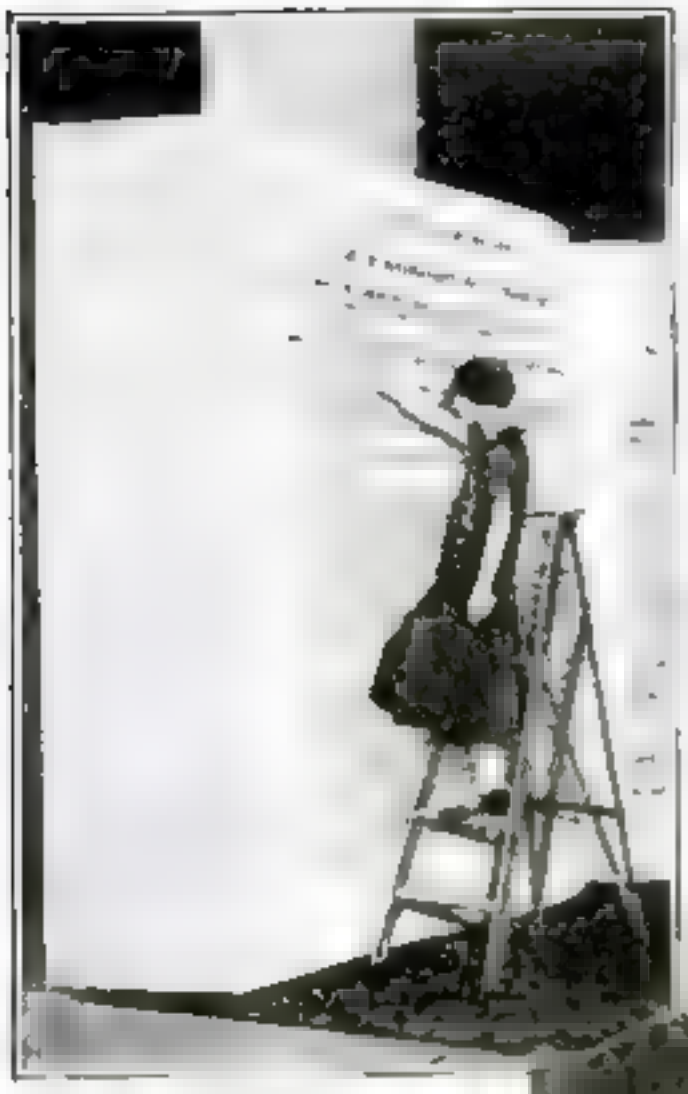
Table Has 6000 Pieces

Six thousand bits of wood are in this inlaid table of well seasoned pine, upon which S. M. Perry, of Midian, Kan., has spent spare moments that amount to 1½ years

"Painting the Lily"

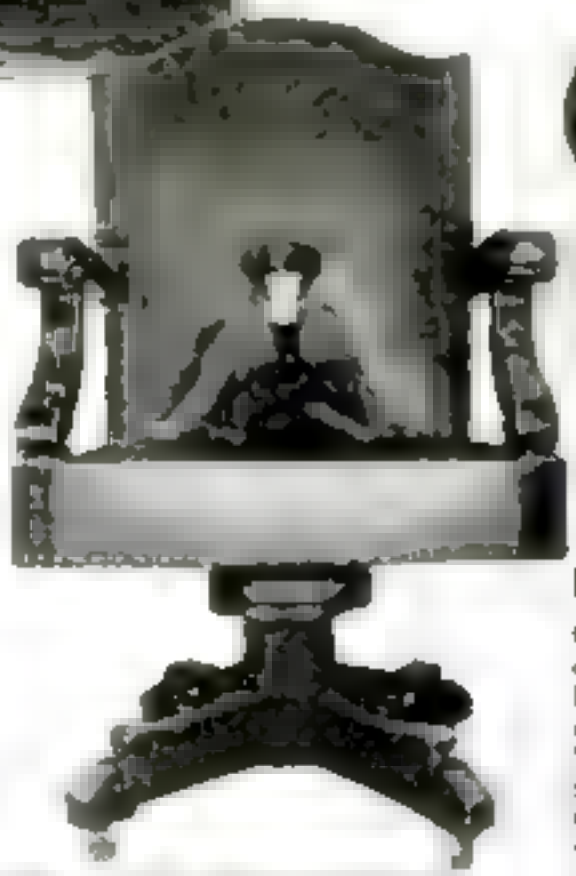
By a remarkable new electro-chemical process, Fred Maas, of New York, plates flowers, foliage, and even animal tissue with precious metals in such a way that the appearance of the original is retained for a long time

Have You Seen Them Any Bigger?



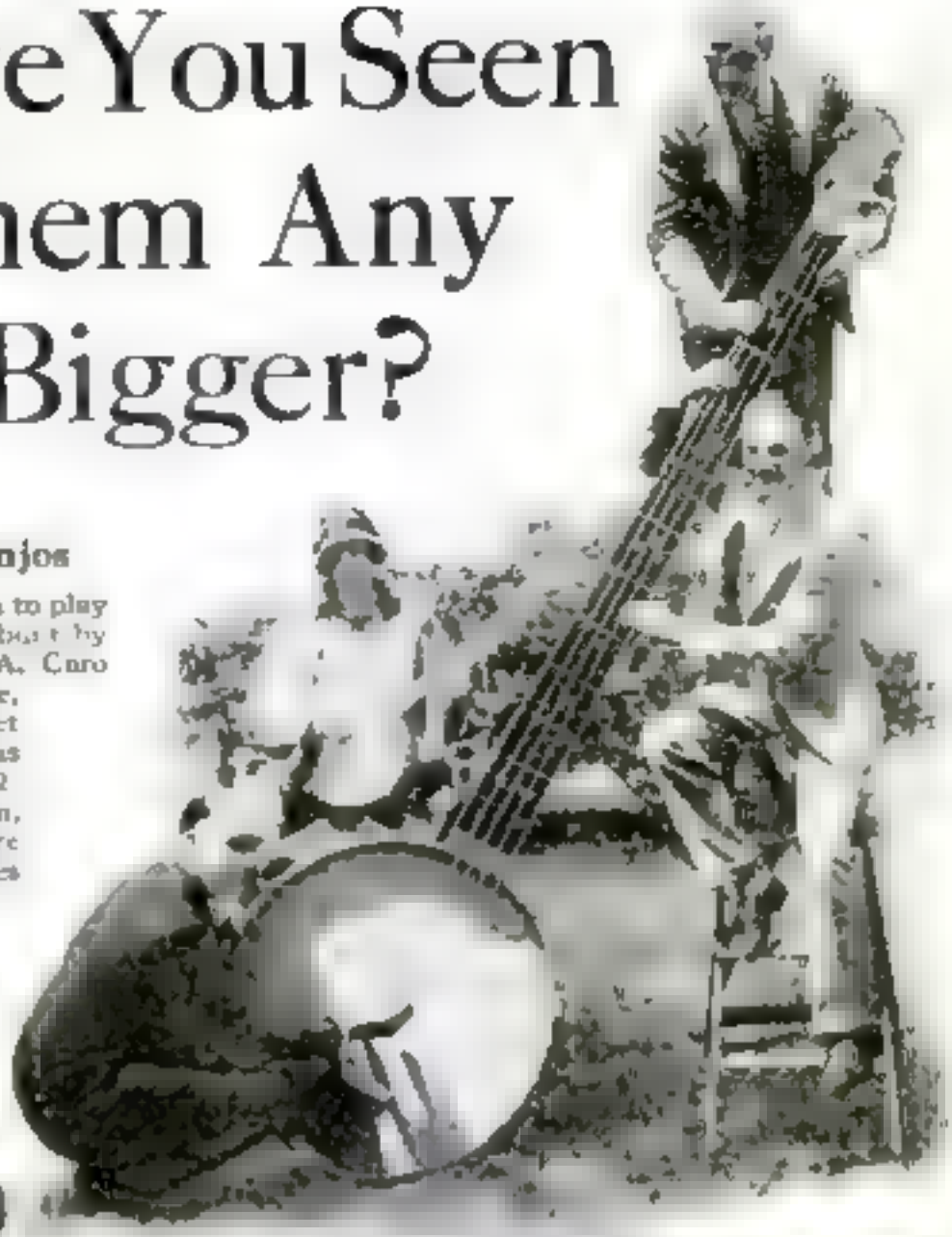
Climb and Read

You need a tall step-ladder and a roving pair of eyes to read the world's largest book, exhibited recently in New York City. Here is Bertha Green, of Greenville, S. C., scanning its pages which are 10 feet tall and seven feet wide



Lost in a Chair

She's a girl of normal size in the world's largest office chair. It took two men to lift her there, for the gigantic chair is nearly 11 feet high and more than six feet wide

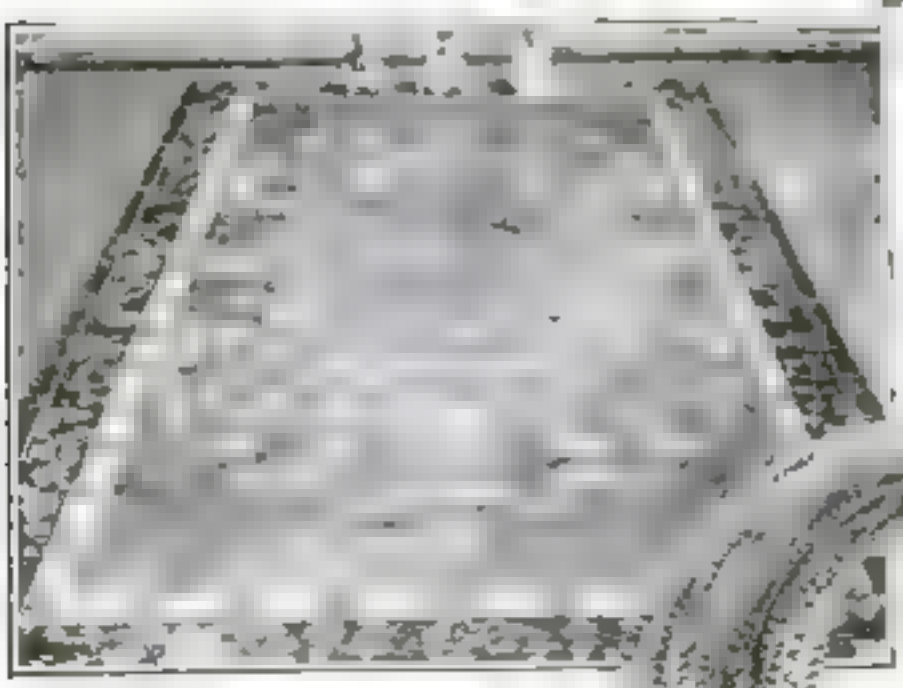


King of Banjos

It takes three men to play this giant banjo built by Roy Kearn and A. Caro Miller of San Jose, Calif. It is 10 feet tall. The head was made from a 32 inch bass drum, and the strings are heavy piano wires

Longest Chip

One of the longest chips ever cut below recently came from a huge bucket wheel in the shops of the General Electric Company, Schenectady, N. Y. The steel chip is 150 feet long and an inch in diameter



Would Fill a House

Part of the wall of a Chinese rug factory had to be torn down before this immense rug could be removed. It was woven for the Cincinnati Business Men's Club, where it covers 920 square feet of floor space. Comparison with the men will give an idea of its size

Big as a Chimney

Here is the largest pipe of an organ so powerful that its music can be heard for five miles. It was completed recently for a park in Los Angeles, Calif. This pipe, made of lumber three inches thick, is 32 feet long and three feet square at the large end. A 50-horsepower electric motor supplies power for playing

Strange Things *and* Places

Realistic Camp-Fire Girl Made of Butter

A CAMP-FIRE girl modeled in butter won first prize for artistic and ornamental display of creamery products at a recent fair in Spokane, Wash. Miss Helen Kane of Spokane, who posed for it, wore the gown, moccasins, and honor beads of a Torch Bearer, the highest rank in the organization.

Howard Fisher, of Portland, Ore., made the statue, which was declared excellent both in its detail and in its general artistic effect.

Bright Colors Mean Little to the Peacock

WE MAY be misjudging the peacock and rooster when we call them vain birds. For Dr. H. Erhard, of Munich, who has been experimenting with the eyesight of birds, says that the shimmering colors in plumage probably mean nothing to the feathered creatures. At least, they do not appreciate colors as we do, if indeed they even distinguish one color from another.

Birds that fly by day, Doctor Erhard says, see everything in a bright red-orange light, being very slightly sensitive to the short waves that make up blue and violet. Night birds, on the other hand, never see red, but do see blues and violet. Tiny globules of oil in the retina of the eyes act as color screens and determine the birds' color sense, according to Doctor Erhard.

Warbling Crickets Are the Canaries of the Orient

ALL the way across the Pacific recently, a tiny cricket sang with a voice as sweet and strong, it is said, as many a feathered bird. It was in a tiny bamboo cage, and came from Yokohama to a family in Seattle, who wanted it for a pet.

Both the Chinese and Japanese are fond of crickets for pets. They catch them in midsummer, put them in little cages and hang them in their rooms. The cricket that arrived in Seattle, it is said, sang not by rubbing its wings together, as our black crickets do in this country, but seemed to possess a different and mysterious kind of musical apparatus.

In the Orient there are big insect markets, where the natives buy their strange pets. The illustration at the right shows a Japanese woman in a Tokyo market choosing a cricket.

A cricket merchant in Tokyo, far Japan

THE world's highest aerial tramway, from 15,000 to 17,000 feet above sea level, more than five miles in length, is used at a Bolivian tin mine.

Elaborate Little Lighthouse Is a Radio Set

Novel radio set built in the form of a lighthouse

IN HIS odd hours, Alex Goldstein of New York City [illegible] receiver into a miniature lighthouse [illegible] attracting detail is a remarkable piece of workmanship.

The detector unit of a three-tube set is mounted in a glass inclosure at the top of the tower, while a two-stage amplifier is inside. A window forms the bell of the loudspeaker.

A tiny mast and flagstaff support a miniature antenna running to the top of the tower. Around the lighthouse yard is a white wooden fence, while in the yard is a realistic dog.

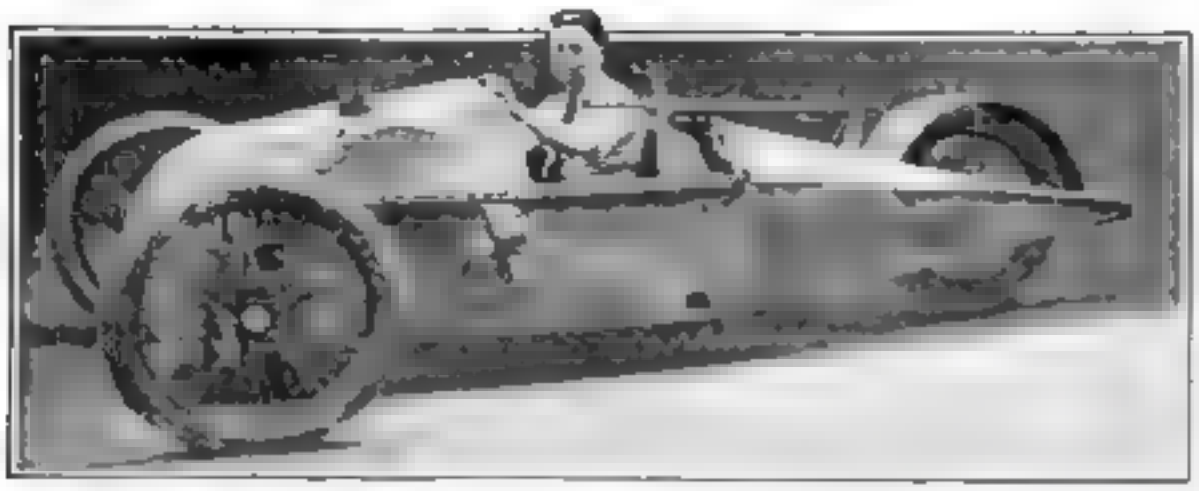
Where Roots Are Dug to Make Your Pipes

THESE irregular chunks, resembling lumps of coal, some day will be smoking pipes. They are chunks of briar roots being weighed on the island of Corsica.

White heath, or briar-root, grows extensively in the southern part of France and in Corsica. The roots are dug up, cleaned of earth and the decayed parts removed, after which the roots are weighed. They then are cut into blocks with circular saws. Cooking these blocks at a low temperature for 12 hours turns them a rich golden-brown color. The briar-root then is ready for shaping into pipes.

Briar-root for pipes being weighed for shipment

Seen *by a* Cameraman



Odd Cycle Car Made from Airplane Parts

OF ALL the strange vehicles seen on the streets of European cities, the one illustrated above is among the oddest. It is a motor car made entirely from spare airplane parts. Roger Ruenot, a Parisian, saw possibilities in the parts for a runabout and put them together as an experiment.

The car is fitted with a nine-horsepower motor and seats two persons. The body hangs low, barely clearing the ground. The inventor is shown just as he is about to start on a long tour with his unique car

Old Signboard Demonstrates how Paint Resists Weather

THE unfriendly wording of this old painted wooden sign becomes more vivid each year, because during the years the background, unprotected by paint, has weathered away. Microscopic examination showed that rot organisms had not been responsible for this etching. Rain and heat alone are responsible for it.

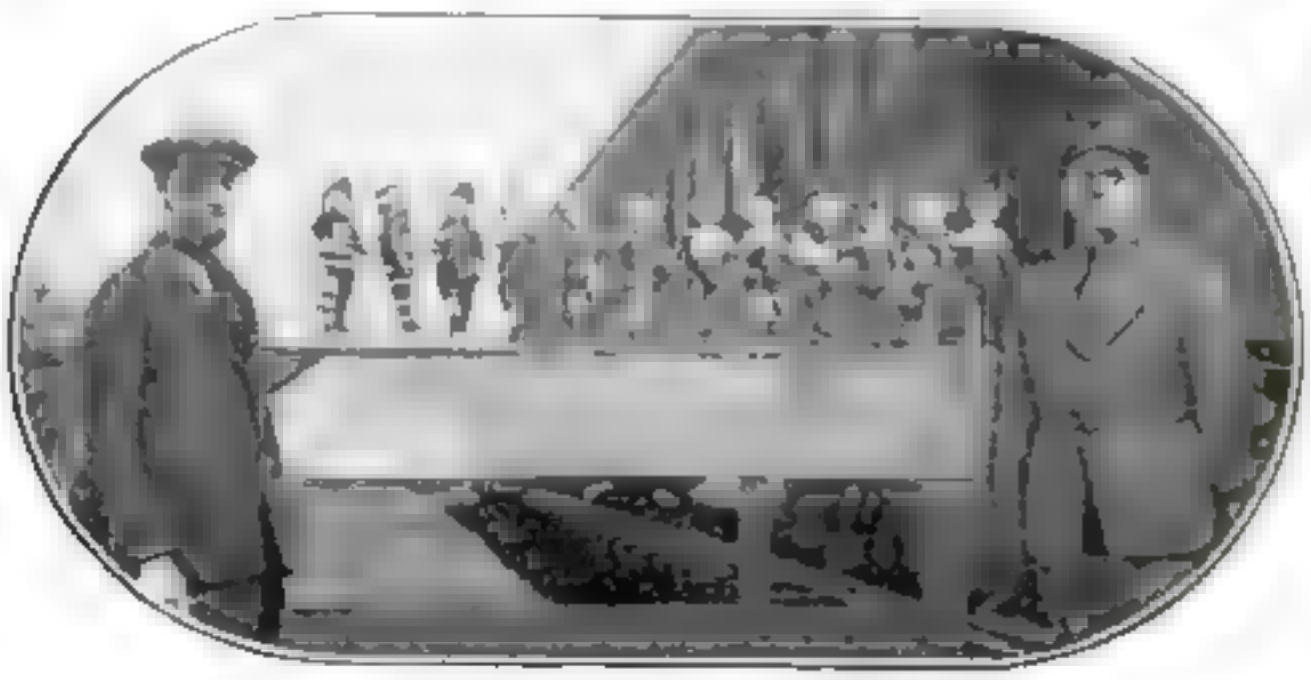
"Weathering" is checking, cracking, splitting, tearing, swelling, and shrinking of the wood, caused by the alternation of wind and sunshine, and also includes any mechanical wear from wind, rain, frost, or hail. It is not claimed that paint will entirely prevent rotting. Paint is, however, the best known protection against weathering.

Signboard etched by the weather

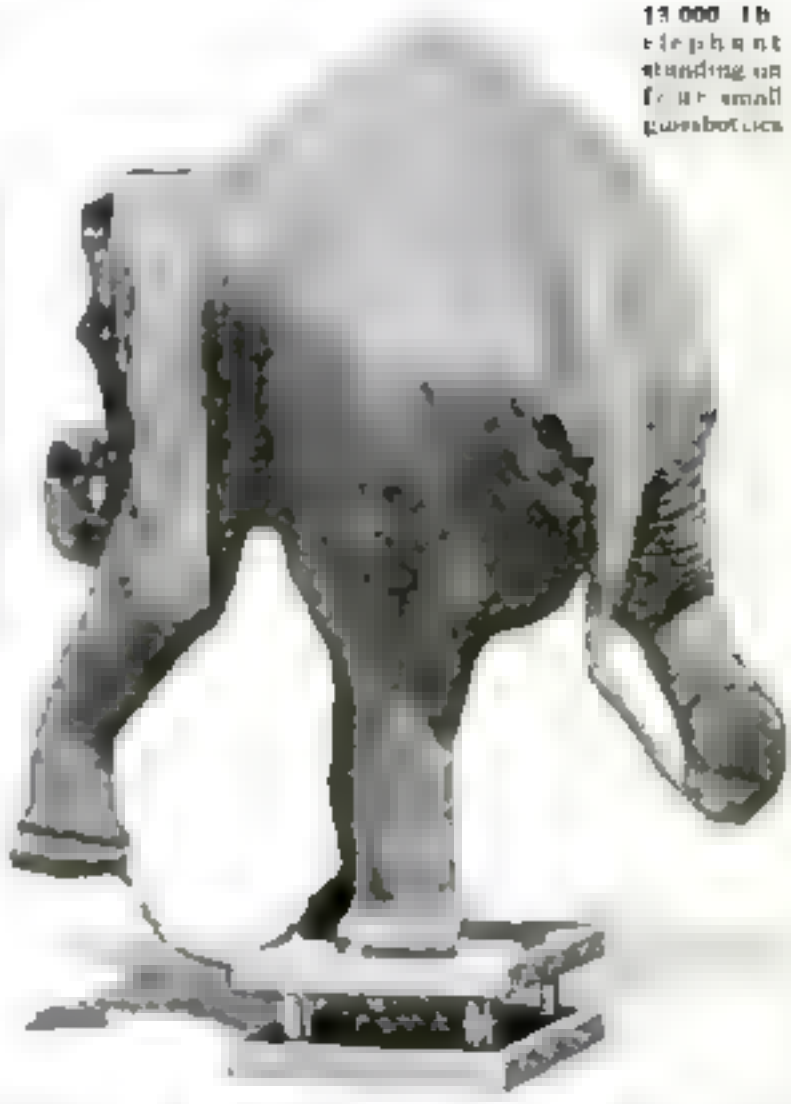
Troupe of Traveling Dolls Teaches First Aid

WHAT is probably the only collection of dolls ever made by a government agency is traveling in a special car through the United States, demonstrating to mining communities the correct ways for bandaging injuries. Some of the dolls have sprained ankles or fractured thighs, some broken arms, while others have their heads generously swathed, suggesting that class of common mine accidents caused by the fall of loose rock, slate, or coal upon miners' heads.

The Federal Bureau of Mines considers this demonstration by means of dolls its most effective way of teaching how to apply bandages before the arrival of a physician. The dolls are both masculine and feminine. A number of them are soldier dolls. The engineers and miners who live in the mine-rescue cars, with the dolls for company, naturally have applied nicknames to them. Among those seen in the picture are Jiggs, Blondie, Sally Ann, Cap'n Jinks, and Buddie.



How mining communities are taught to give first aid to the injured

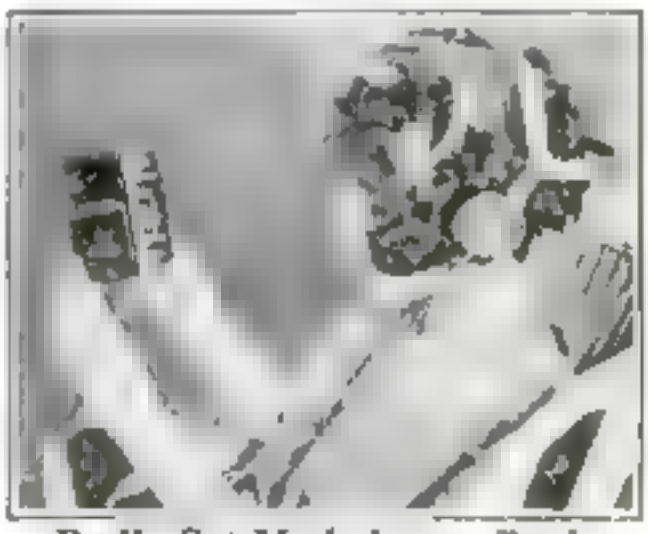


13,000 lb elephant standing on four small glass bottles

Huge Elephant's Only Support Is Four Half-Pint Bottles

TREAD lightly, Babe, and, whatever you do, don't try the Charleston. For Babe, you will see if you look closely, is standing on four empty half-pint bottles. And Babe is no light weight. In fact, he is said to be the largest elephant in the country, tipping the scales at 13,000 pounds.

Balancing on glass isn't one of Babe's ordinary stunts. He did it at the Public Zoo at Toledo, Ohio, recently for the entertainment of visiting glass manufacturers, who beamed when they saw this demonstration of the quality of American manufactured glass. For even under this tremendous weight, not a single bottle was broken.



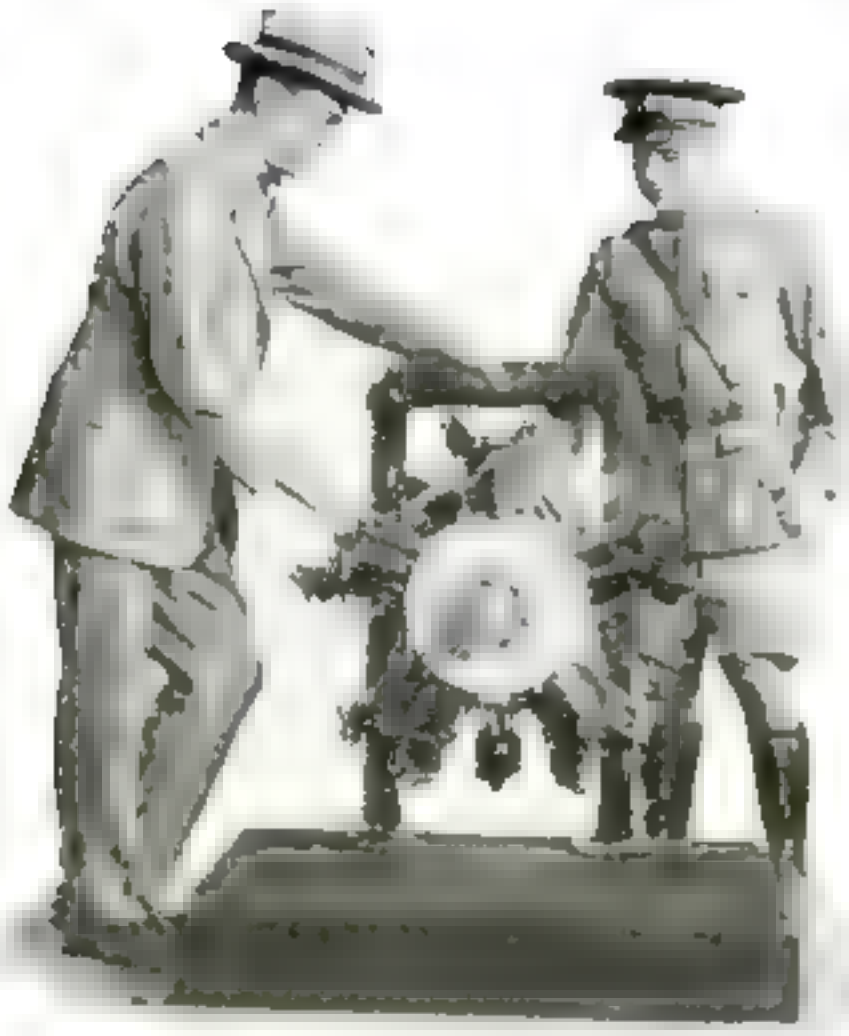
Radio Set Made into a Book

ONE of the interesting exhibits at a recent radio show in London, England, is the small volume shown above, which carries between its covers a complete radio set. Its maker, E. R. Fano, bound the book in tortoiseshell and entitled it "The Listener"

POPULAR SCIENCE MONTHLY will be glad to answer, wherever possible, all inquiries addressed to its Information Department

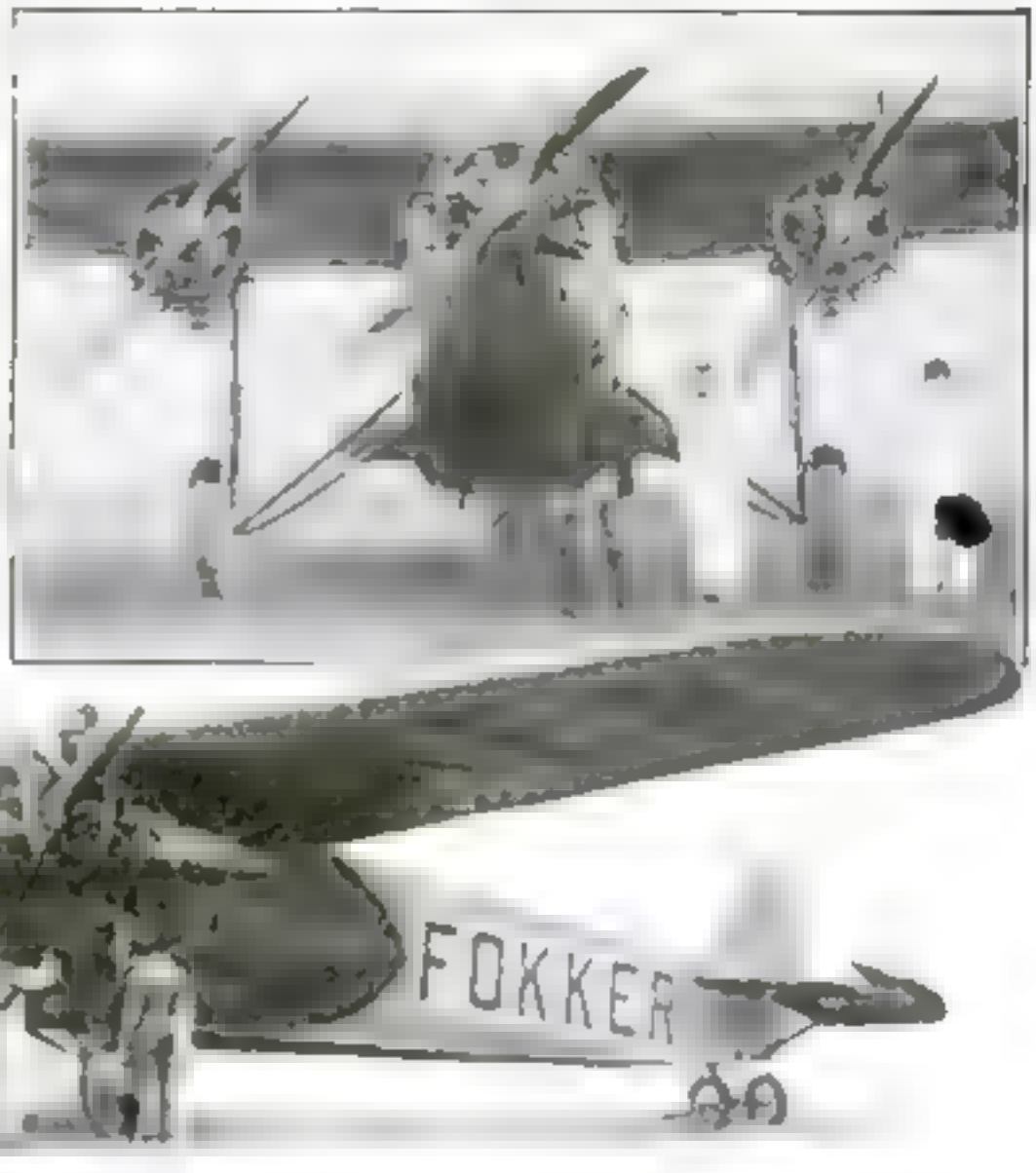
On the Wing with the Airmen

Newest Marvels of Aviation



Designs New Motor for Commercial Planes

After seven years of experiment Capt. E. V. Rickenbacker (left), American ace during the war, has just completed this new type of rotary motor for commercial planes. He is seen demonstrating it to Maj J. H. Rudolph, U. S. Army technical expert, at Mitchel Field, N. Y. Captain Rickenbacker is a leading figure in the development of commercial aviation



"Foolproof" Passenger Plane Driven by Three Engines

What is claimed to be the nearest approach to a foolproof airplane is this three-engine, 10-passenger Fokker monoplane, which, with engines stalled, refuses to side slip or spin. The upper view shows the arrangement of the three propellers

The latest development in flying boats is this huge all-metal monoplane built by Danish designers for the British Air Ministry. The photograph shows the big boat at Felixstowe, England, after a non-stop flight from Copenhagen. Even the wings are of metal. Notice the two motors mounted high above the fuselage, to escape flooding when boat rides the water

A Thrilling Parachute Jump

Here is a most remarkable photograph of a parachute jump. The camera caught Lieut. J. R. Tate an instant after he left the wing of a navy plane 2000 feet above beautiful Pearl Harbor in Honolulu

Lieutenant Tate standing on the wing of the plane just before making his remarkable jump

Miniature Planes Compete in Races

Model airplanes had their day of racing during the International Air Meet at Mitchel Field. [illegible] from aviation clubs in all parts of the country were given a chance to demonstrate their remarkable miniature machines and to match their skill in flying them. The photograph below shows some of the entries in the competition

Safeguard for Pilots

A remarkable device to prevent stalling of a plane in flight has been perfected by Major J[illegible] Savage, inventor of sky writing (right), who is seen demonstrating the device to C. B. C[illegible]lver, skywriting pilot. A miniature wing or vane is attached to a strut near the end of the wing. Ordinarily the vane remains level, but if the nose of the plane points upward at a dangerous angle, the wind flow pushes the vane up, opening a valve. This is connected through relays with a pneumatic device that pushes the control lever forward, warning the pilot of his danger

Some Inventors *and*

Bernaya Johnson frying an egg over a cake of ice

He Fries Eggs on a Cake of Ice

WOULD you believe it possible to fry an egg in a frying-pan held over a cake of ice? To demonstrate that it can be done, Bernaya Johnson, well known New York radio engineer and inventor, recently devised the apparatus pictured at the left.

The probable explanation is this: Beneath the table top is concealed a coil of wire through which high frequency current is passed. When the frying-pan is placed in the magnetic field of this coil, an electric current is induced in the iron of the pan, heating it sufficiently to cook an egg At the same time the current has little or no effect on the cake of ice resting on the table.

Michael V. Ventrella shows how our [illegible] device turns a page of music

Young Musician Perfects Automatic Page Turner

AFTER seven years of patient experiment, Michael V. Ventrella, a young New York musician, has invented an ingenious pedal device that makes it possible for the musician to turn pages of music without taking his hand from the instrument he is playing. All that is necessary is to step on the pedal that actuates an arrangement of levers that turns the pages of the music automatically.

The device can be applied to a piano as well as to a music stand, the inventor claims, and can be adjusted to turn the pages of a book at any height. When idle it holds the pages flat and firmly on the rack, and so keeps them from blowing in the wind and causing the player to lose his place. It is said to be noiseless in operation

Talking Motion Pictures Sent by Radio

SOME day soon you may sit at home and receive a whole moving-picture show over your radio. Not only that, but the actors actually will talk.

At the right is C. Francis Jenkins, of Washington, D. C., experimenter in radio vision and radio movies, demonstrating the apparatus with which he recently transmitted a motion picture and verbal description of it at the same time.

C. Francis Jenkins with talking movie machine

Foot Toboggans Provide a Novel Winter Sport

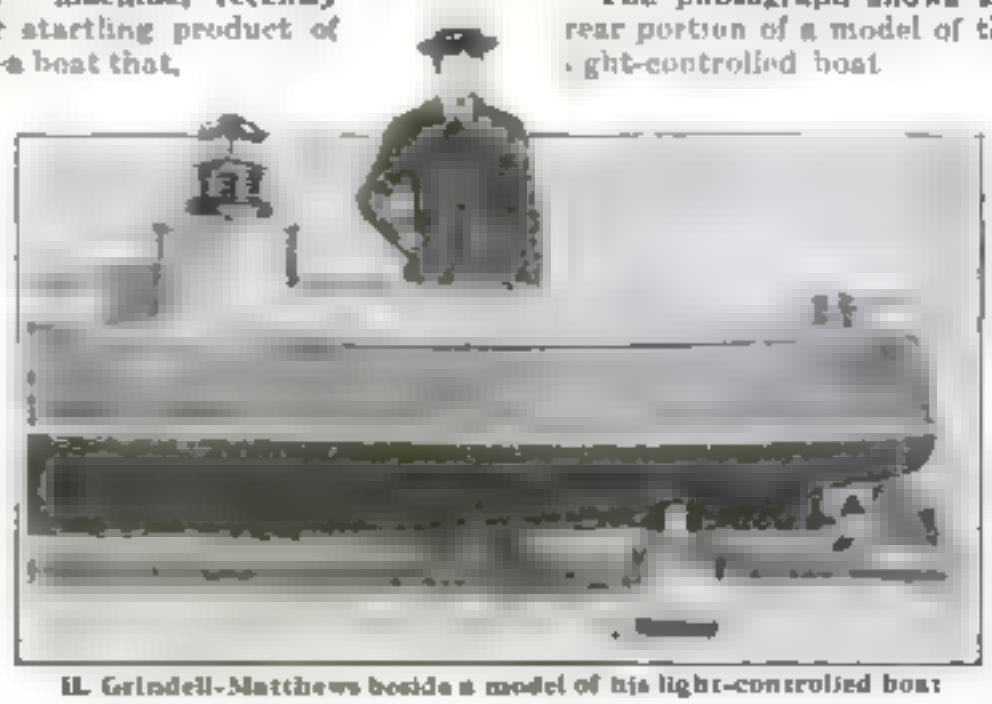
PROBABLY every boy has tried sliding on barrel staves or other improvised snowshoes. It was while helping his own boys to build sliders that a Missouri manufacturer hit upon the idea of the foot toboggans pictured below. Resembling sandals, they are strapped to the shoes like skates. The soles are of thin corrugated metal, to provide traction on smooth ice, and so make it possible to control movement. They can be used either for skating or coasting

Strapped to the feet like skates, the shoe toboggans can be used either for coasting or for skating

Guides Amazing Boat by a Beam of Light

THE well known English inventor, H. Grindell-Matthews, creator of the famous "death-ray" machine, recently announced another startling product of scientific research—a boat that, he claims, may be guided from a distance of more than five miles by a beam of light. The beam striking an instrument on the conning tower of the boat, will operate the engine, steer the boat in any direction, the inventor says, and also will fire a small gun mounted at the stern. For coastal defense in time of war, such a boat might prove exceedingly effective.

The photograph shows the rear portion of a model of the light-controlled boat



H. Grindell-Matthews beside a model of his light-controlled boat

Their Ingenious Products

The inventor showing how the golf ball is driven with an over head hurling motion

Hurler mid hurler and the sinker

Crippled with Rheumatism, He Invents New Golf Game

HANDICAPPED in his golf game by rheumatic pains that troubled him every time he swung at the ball, N. E Warwick, of Cleveland, Ohio, refused to give up his favorite sport. Instead, he invented a remarkable new form of golf, in which the ball is hurled with a whipping motion above the head instead of being driven from the ground.

With light, whiplike sticks he now claims he can make a better score than ever before. The heads of the sticks are cups that hold the ball Warwick has developed three kinds of clubs—the hurler, for the long shots ordinarily made with driver or brassie; the mid-hurler, corresponding to the midiron; and the sinker, corresponding to the putter With the hurler Warwick claims to get more distance than the ordinary golfer gets in the average drive off a tee

Embossing Machine an Aid to Blind Printers

ONE of the most remarkable publications in the world is the *Ziegler Magazine for the Blind*, published in New York City; for it is produced almost entirely by blind persons. To facilitate the printing of braille type, in which combinations of tangible raised dots represent the letters of the alphabet, Joseph Brusca has invented the machine shown at the right. It is used in an improved method of embossing press plates.

Joseph Brusca embossing braille letters with his new machine

The inventors with their "gravity motor"

The Latest Idea in Perpetual Motion Machines

ANOTHER perpetual motion machine! Till the end of time men will keep at it. You can't discourage them.

The undiscouraged inventors in the photograph are W. J. Winkelman (left) and J. K. Deem, of Los Angeles, who claim to have invented the only workable perpetual motion machine offered to the mechanical world. Through a combination of levers, it utilizes the law of gravity, they explain. The inventors believe that gravity motors will make the desert and remote portions of the country habitable by providing self-generating plants for lighting, heating, and household needs.

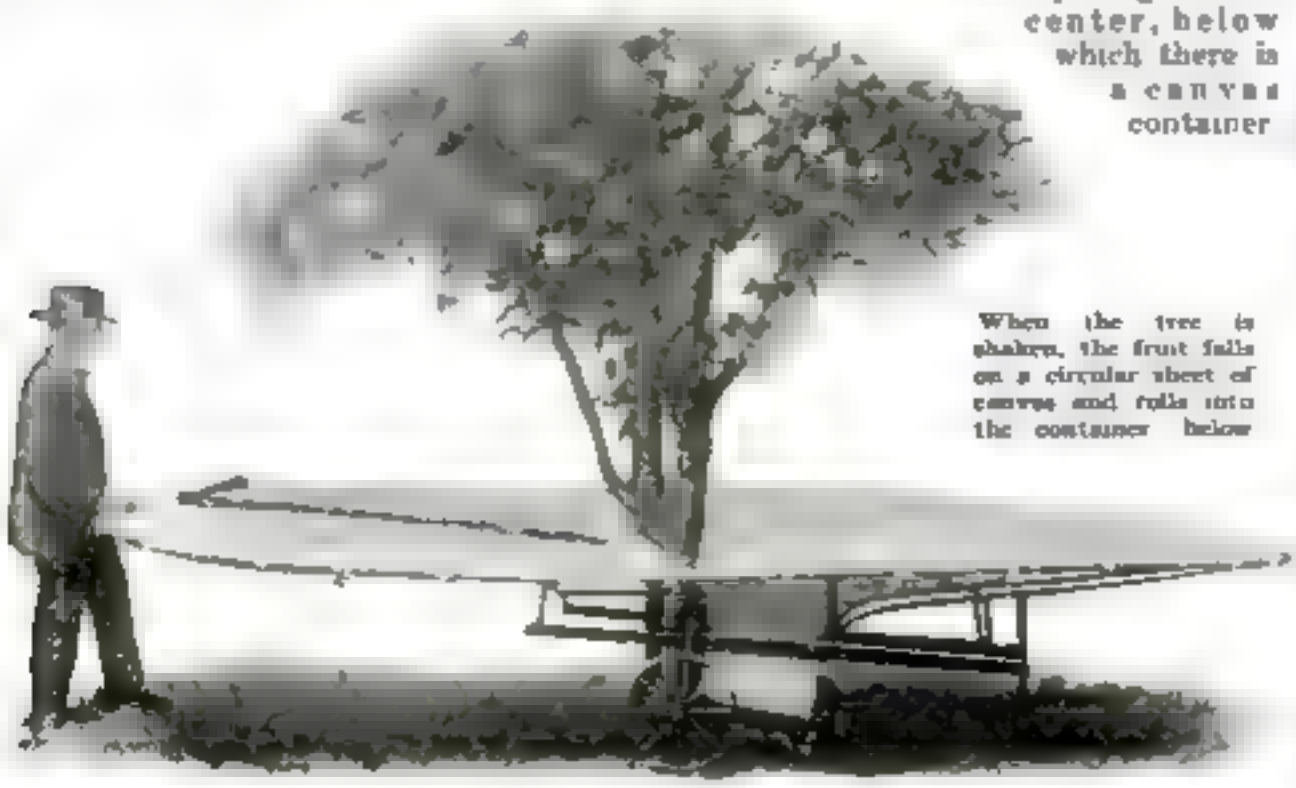
Revolutionary Steam-Boiler

A STEAM-BOILER of revolutionary design has been produced by a German engineer-inventor, Bernhard Becker. When stripped of its insulation, it is a cubical box only about 18 inches on a side; but its inventor claims it can produce more than 600 pounds of steam an hour and get up a pressure of 300 pounds to the square inch in five minutes.

Canvas "Lap" Gathers Fruit without Bruising

IN ORCHARDS near Portland, Ore., a unique fruit gatherer is being used to catch all of the fruit without bruising it The device, perfected by Arthur Hedder of Portland, is mounted on wheels like a wheelbarrow

When the tree is shaken, the fruit falls on a sloping sheet of canvas and rolls into an opening in the center, below which there is a canvas container



When the tree is shaken, the fruit falls on a circular sheet of canvas and rolls into the container below

Traffic Cop a Semaphore

TO SAVE trouble and confusion in regulating traffic, A. Seua, a Malay policeman, carries his own semaphore in the form of light, basket-woven "wings" strapped to his back. Whenever he is ready to change the direction of traffic at a street corner, all he needs to do is to turn his body to give the signal, which no driver can mistake easily.

Sixteen Answers to a

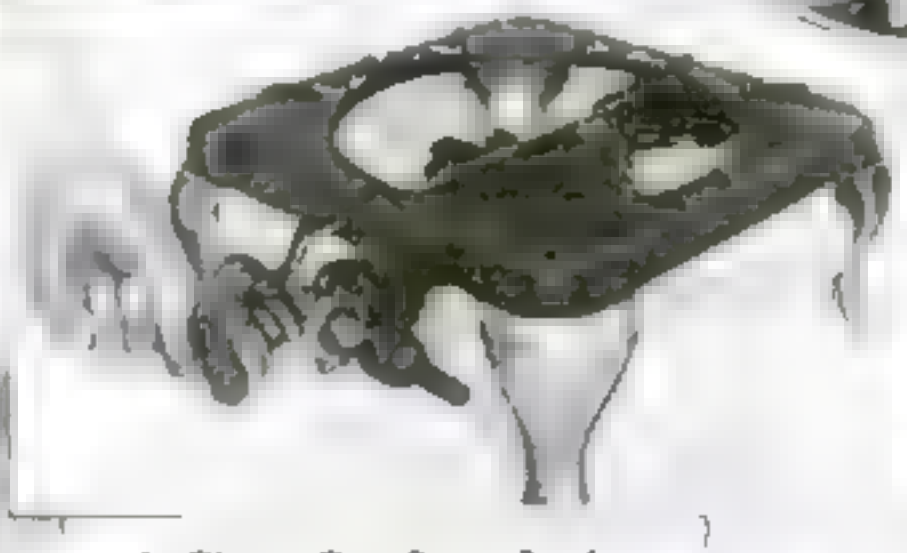
Improved Utensils and Conveniences to Meet the

For More Space in the Kitchen

At the right is an over the sink cabinet that is very handy for all the many small things used in a kitchen. An under the sink table is also used in conjunction with the cabinet. It contains drawers and a compartment for all the kettles

Electric Light Cooks Food

With the heat of ordinary electric-light bulbs it now is possible to cook and bake. This new cooking device is said to reduce the fuel bill considerably. Food is put in the container and the current turned on



Tiny Manicure Set

Handy for a woman's bag is a manicure set with four tools, carried in a case three inches long. Each tool screws into the end of the case. The case is made of a non-inflammable celluloid substitute, prettily engraved

It Closes Gas-Stove Leaks

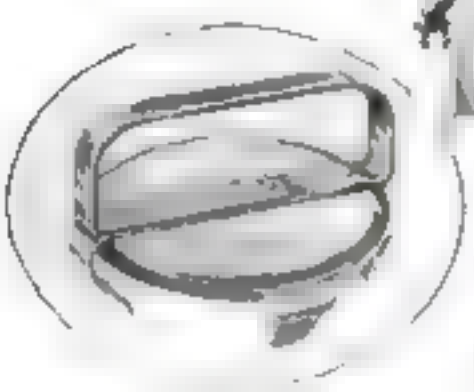
To prevent accidents from escaping gas, a thermostatic control for gas appliances has been devised. If for any reason the gas pressure gets low or the gas goes out completely, a rod extending over the gas burner contracts, closing the valve automatically

Wheels Cut Can Open

A pair of shearing wheels does the cutting. This can opener uses the principle employed for shearing metal in factories. The shaft on which the wheels turn is pivoted on a punch inserted at the can's center

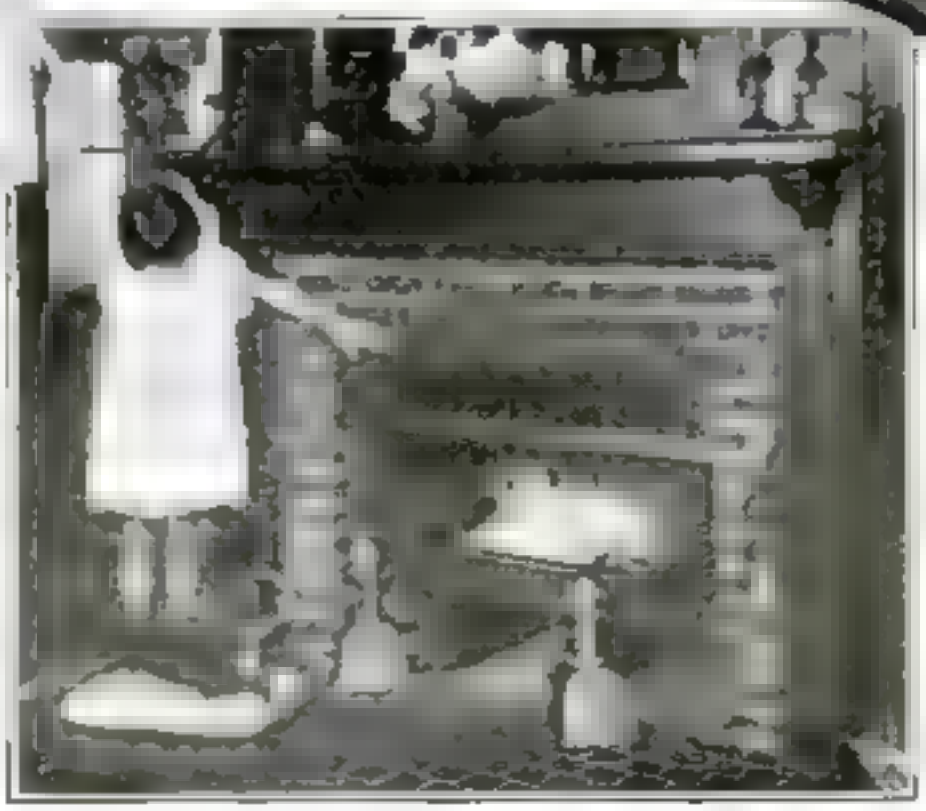
For Left-Handed Peelers

Considerate of the left-handed housekeeper, a manufacturer has made an adjustable potato peeler that can be fixed to accommodate her. At the right is the device adjusted for left-handed peeling



Handy Milk-Bottle Holder

Sally won't come home crying over spilt milk. Her mother gives her a new milk-bottle carrier to take with her to the store. It fits over the bottle and provides a convenient handle. It can be used, too, to hang up the milk bottle

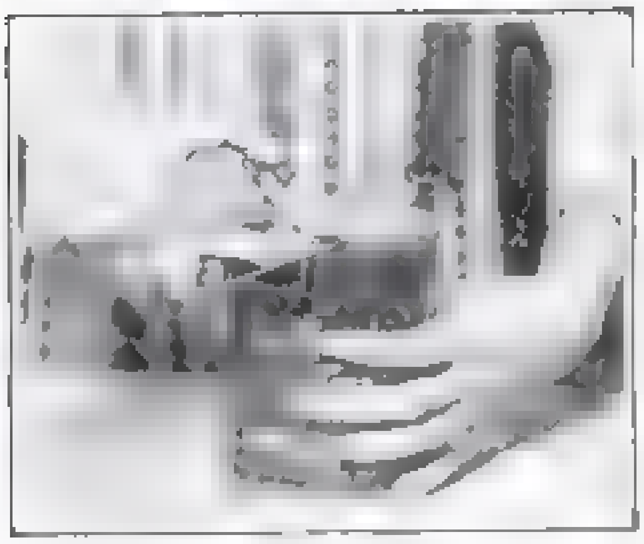


More Heat from the Fireplace

The device at the left prevents heat waste by doubling a fire's radiating surface. Fresh air enters through the hearth and hollow andirons to a distributor behind the fireplace. It flows through flexible copper heating tubes to a register above the fireplace, then out into the room. The equipment is said to work in any fireplace that burns without smoking. The air may be run through a pipe from the outdoors

Housewife's Problems

Demands of the Wide-Awake Woman

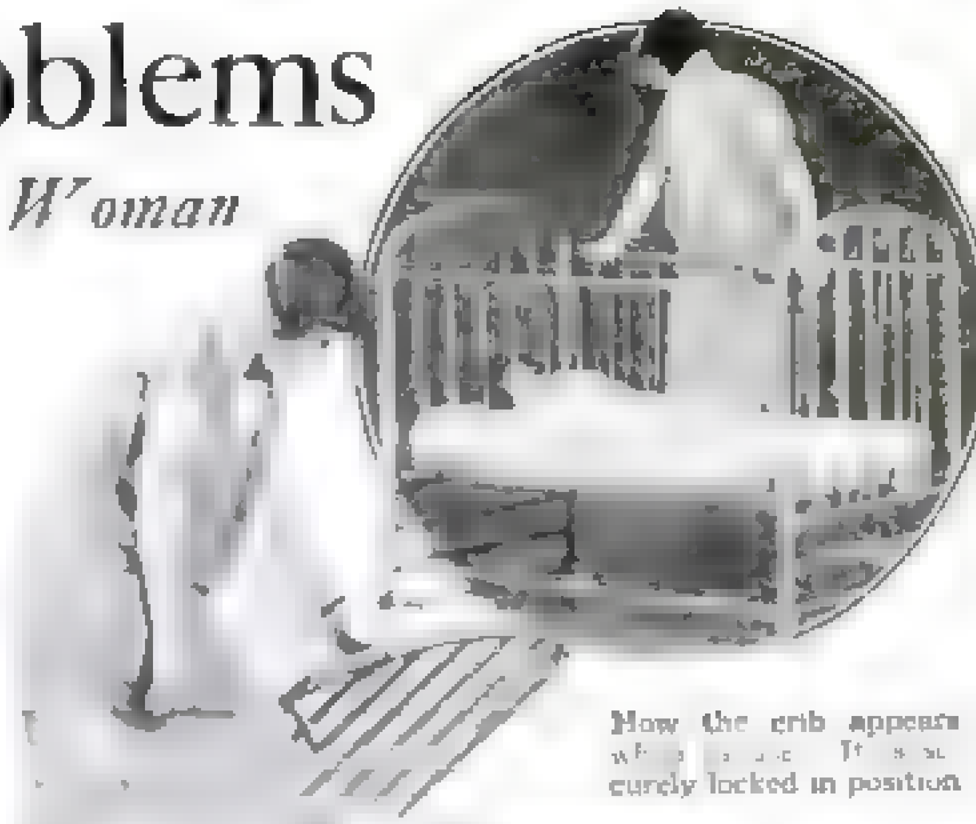


Opens Cans with Key

This unique can opener has nothing on which the housewife can cut her fingers—no knife; no sharp edges at all. It clamps on the side of the can and the key is turned to remove the top of the can

Folding Crib Saves Space

Do you remember the old-fashioned crib that rolled under the bed? Here is a modern version of it. The mattress and bedding remain on the bed when it is folded. It is a space saver, yet provides plenty of room for a child

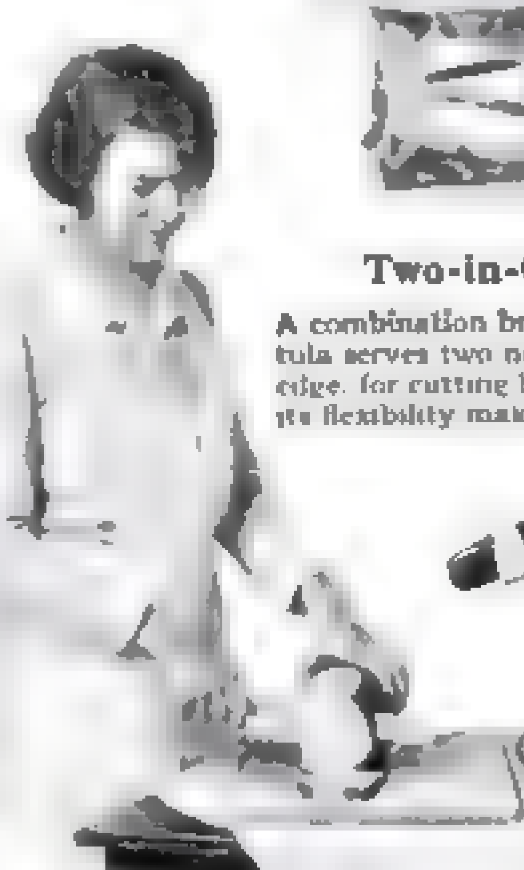


How the crib appears [illegible] It is se-curely locked in position

When folded, the crib can be pushed easily under a bed

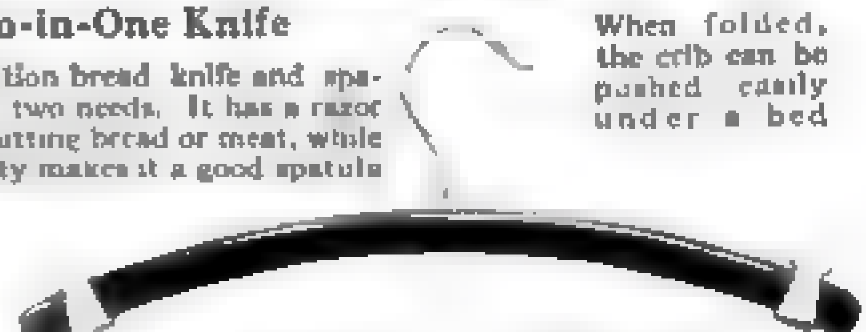
Wax Paper Folds Neatly

With wax paper put up in the convenient form shown below one sheet at a time can be removed without disturbing the rest. The balance goes back in the roll, which is secured by the folded cover and a string



Two-in-One Knife

A combination bread knife and spatula serves two needs. It has a razor edge for cutting bread or meat, while its flexibility makes it a good spatula



Garments Held Securely

Rubber tips for garment hangers keep the garments from slipping off and falling to the floor. The tips may be moved at will

To Grease the Griddle Pan

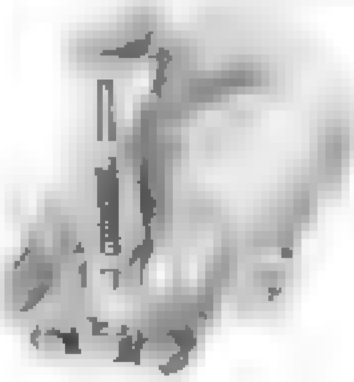
A new piece of cloth for each griddle greasing may be fastened in this wire holder. A small pan for the grease is provided

Newest Electric Refrigerator

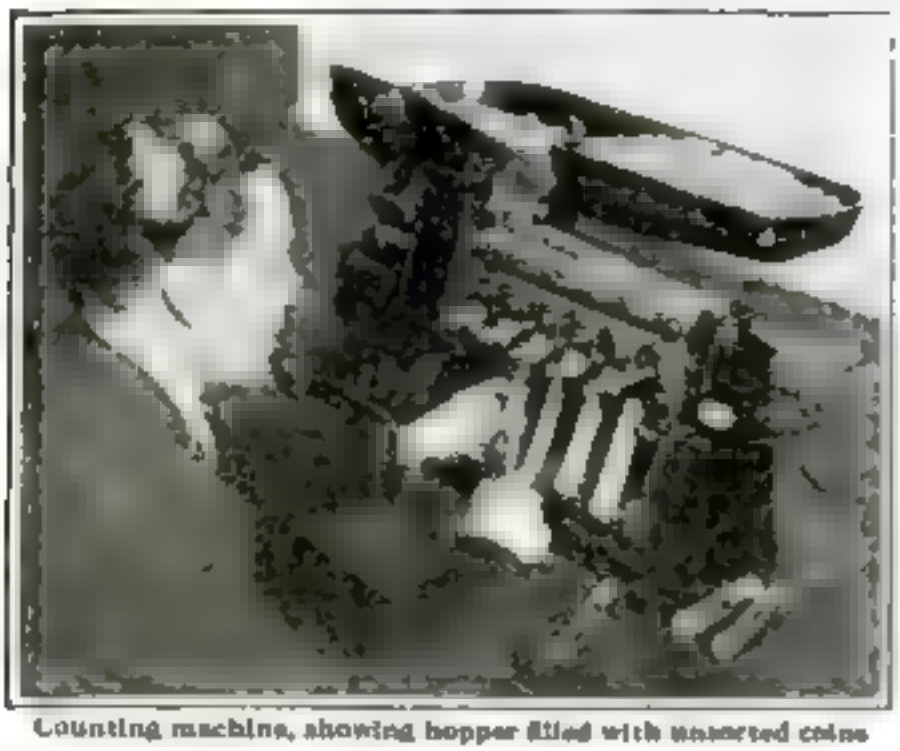
This electric refrigerator is claimed to be practically silent in operation and to require no attention for lubrication. All the refrigeration mechanism is contained in one unit, set in the brine tank through the top of the cabinet. The unit is suitable to several sizes of boxes. [illegible] insulation [illegible] and easy [illegible] possible [illegible] purposes. [illegible] are [illegible] The [illegible] required is to shut down the machine overnight once or twice a month to allow the accumulated frost in the brine tank to melt away

Cherry Pitter Leaves Fruit Whole

This aluminum cherry pitter drives the stone out in a moment, leaving the fruit whole. It fits the hand and there is no crushing of the fruit



Coins Sorted and Counted Automatically



Counting machine, showing hopper filled with assorted coins

FOR business houses where thousands of coins of all denominations must be counted in a day, this ingenious automatic coin-sorter and auditing machine has been perfected.

At one end is a hopper into which coins, bills, and checks are emptied. After removing the paper money, the operator simply presses a button to start the machine. In a moment all the coins are sorted automatically, counted accurately, and wrapped.

New Air Meter Records Tire Pressure Automatically

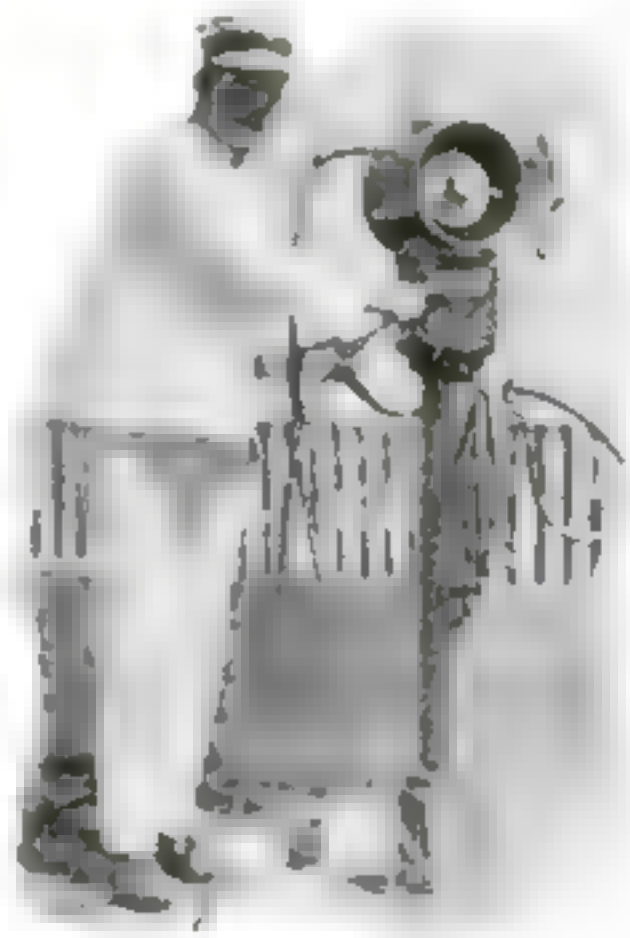
NO LONGER is it necessary for the motorist, getting "free air" at the gas station, to disconnect the air hose from the tire valve frequently to test the pressure in the tire.

An automatic air meter is the latest device for the gas station. The motorist sets the dial, shown in the photograph, at the exact pressure he desires in the tires.

When the dial is set, a light, to which the operator is pointing, comes on. All that is necessary now is to attach the hose to the tire. When the tire is filled to the pressure indicated, the light goes off.

Latest Automobile Will Be Driven by Oil Pressure

AN AUTOMOBILE of revolutionary design, driven by oil pressure, is to be manufactured in Lansing, Mich., according to recent reports. Gears, driving shafts, and brakes are to be replaced by oil-pressure pipes.



A light signals the air pressure

This Fountain Pen Holds a Supply of Stamps

HOW many times, after writing a letter, have you found yourself without a stamp to send it through the mail? Here is a simple but ingenious device that makes it possible to have a supply of stamps always on hand when you need them—right in your fountain pen. A strip of stamps is wound on a small drum that fits inside the pen.

Loudspeaker to Give Warning of Earthquakes

A REMARKABLE instrument that translates the slightest tremors of the earth into sounds that issue from a loudspeaker is the recent invention of a Japanese professor, Dr. Jun Shida of Kyoto University. It is designed to give warning of the approach of earthquakes.

The possible usefulness of the invention lies in the assumption that most severe earthquakes are preceded by slight shocks. Thus, an audible warning of slight tremors would give people time to leave homes and office buildings before the arrival of a destructive quake.

The invention consists of a pendulum, an electric coil, and an amplifier. The pendulum is so delicately poised that it responds to the slightest vibration. When it is set in motion, electricity is generated in the coil, which actuates a sound-producing device. The sound is amplified and issues through a loudspeaker.

Further improvements will make it possible to transmit directly by wireless the sound generated by the first tremor.

A Collar Clasp that Lies Flat on the Neck

ALMOST every man has dreamed of perfecting some kind of a button for the back of the collar that will lie flat without pressing against the nape of the neck uncomfortably. The latest idea is this button that is made in the form of a clamp.

When the head of the button is inserted through the holes of the collar band and collar, a spring hinge snaps it tightly against the base. The device may be used also as a tie clasp.

Rod Holder Devised for the Lazy Fisherman

PERHAPS, if you are the kind of fisherman who gets tired of holding a pole hour after hour, you have had the surprising experience of returning to the creek and finding that your rod, which you left stuck carefully into a mud bank, has been pulled out into the middle of the stream.

For you there has been invented a new rod holder. An 18-inch metal spike is driven into the ground and to this is attached a clamp that grips the handle of the fishing-rod. The rod can be adjusted easily and quickly to various positions, and it is claimed that it is impossible to pull the rod out by a forward pull. The picture below illustrates how the holder does the fishing while the angler looks on.

The rod is held tightly while the fisherman lights his pipe

This Pencil Writes in Five Different Colors

A POCKET pencil that will write in any one of five colors is a new convenience for the office man. It is of the self-feeding type. When a lead of a certain color is to be used, an indicator near the point is turned until it registers the desired color. A twist on a knurled knob at the end of the holder then ejects the lead at the point.

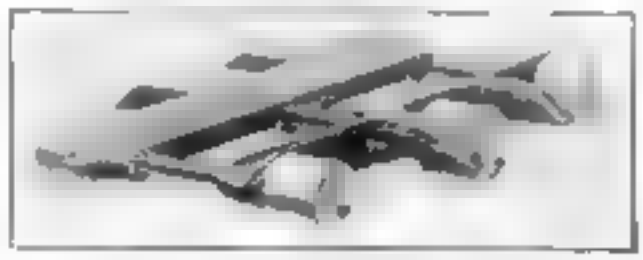
The pencil has a clip to fasten it to the coat pocket.

New Type of Dolly Truck Makes Heavy Work Light

TO FACILITATE the handling of heavy rolls of paper, an Indiana printer has invented the compact but extremely sturdy new type of dolly truck pictured at the right. It has been found equally useful for moving heavy crates, barrels, drums, casks, and other bulky loads

The truck has six wheels. An unusual feature is that the wheels on the center axle are slightly larger than those on the two ends, thus acting as a pivot and permitting tilting. The truck is built low, with projecting skids sloped to within two inches of the floor so that articles can be loaded easily.

Loads with curved surfaces, such as paper rolls and barrels, that usually have to be blocked to keep them from rolling from the ordinary truck, are held securely by the slanting sides of the truck frame.



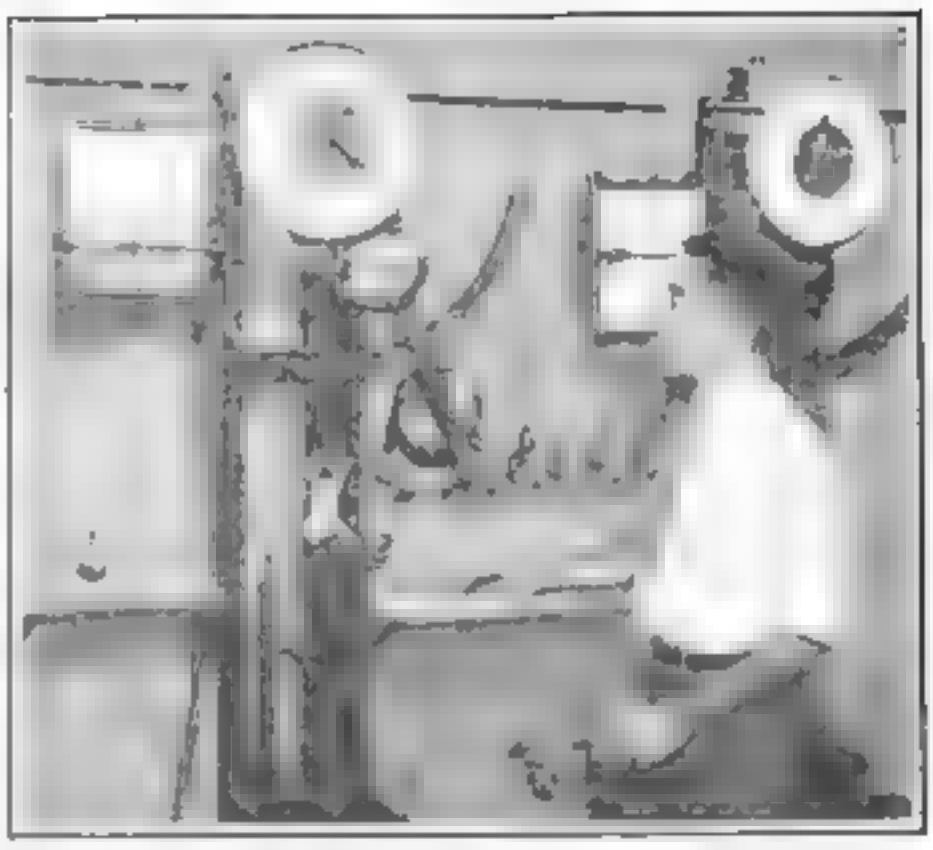
The new dolly, loaded and empty

Measuring Wear on the Seats of Trousers

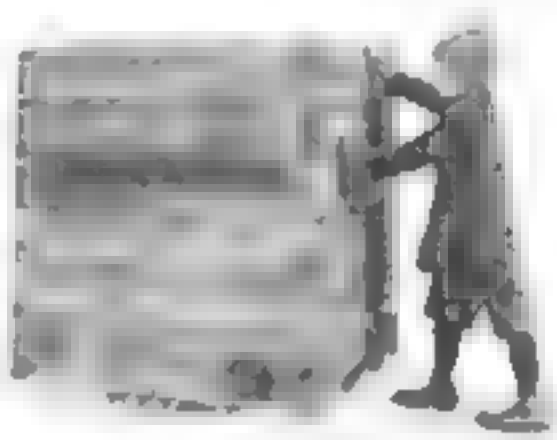
HOW many times can a man sit down without wearing out the seat of his trousers?

A definite answer to this really important question now can be obtained in round numbers from a novel textile-testing machine devised by the U. S. Bureau of Standards to measure the durability of cloth used in making army uniforms.

When applied recently to a new quality of cloth for army trousers, it was found that the wearer could sit down 97,000 times before the cloth showed the least sign of wearing through.



W. J. Stephenson, textile tester of the U. S. Bureau of Standards, measuring wear on trousers seats by the textile-testing machine

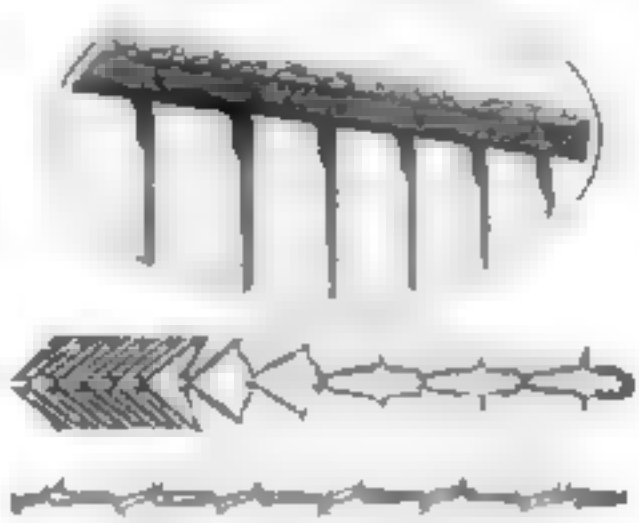


Improved Barbed Wire Is Easier to Handle

SHIPPING and putting up ordinary barbed wire takes a great deal of time. The wire tangles easily, and on account of the barbs it cannot be wound tightly on spools. When it comes to stretching it, torn hands and clothing so often result that stringing barbed-wire fences is counted one of the mean jobs on a farm.

A new product called "barbed band," eliminates most of these difficulties, for it is collapsible. In other words, its barbs are folded like knife blades for shipment, and show up only when the wire is stretched. The wire consists of strong hoop iron punched on both sides, leaving a small barbed band that can be stretched easily.

A ring of about 22 yards of the punched band, weighing about 20 pounds,



showing no barbs, and taking little room contains more than 127 yards of the barbed wire. The sides of the band are very sharp, giving additional protection.

The band may be used not only for fences, but makes a good substitute for wire grating

Charcoal Gas New Substitute for Gasoline

THAT charcoal gas can be used effectively as a substitute for gasoline in motor vehicles was demonstrated recently by the French government in a 1500-mile endurance test for cars using this new form of fuel. It was found that a motor-truck burning charcoal and using the gases of combustion in its cylinders, costs less than one-fourth as much to operate as a similar truck burning gas.

For the use of charcoal gas, no changes in the design and construction of the motor are necessary it is said. The car, however, must carry a wood- or coal-burning furnace, which is fed with charcoal blocks. As the charcoal burns, the gas rises to the top of the furnace, whence it is carried off to the motor There the gas is ignited, much the same as in the gasoline car, and its expansion supplies the power to drive the pistons of the automobile's engine.

Filling furnace with charcoal blocks as a substitute for gasoline

THE glarimeter, the only instrument invented for measuring gloss of paper, has just been adopted by the U. S. Government as the legal standard for newsprint.

A Loudspeaker You Can Build

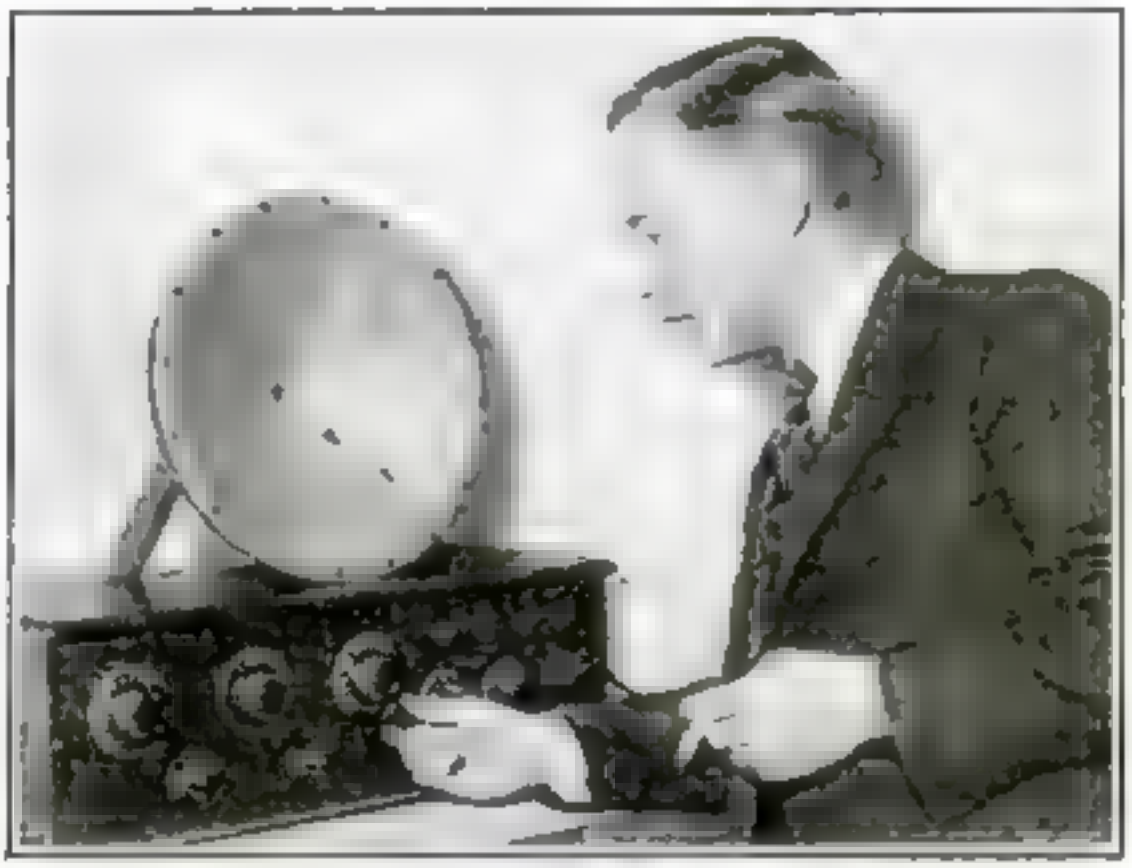
All You Need Is Wrapping Paper, a Chopping Bowl, and a Phonograph Unit to Make It

BY ALFRED P. LANE

LARGE numbers of our readers undoubtedly will be interested in the description of a home-built loudspeaker that is inexpensive, easy to construct, and gives surprisingly good results.

The function of a loudspeaker is to transform the electrical impulses generated in the radio receiver into sound waves in such a way that every slight variation in the electrical current will be reproduced in the form of sound. It should produce plenty of volume with minimum distortion. In other words, the music or speech should be clear and loud enough to be heard properly

Judging of loudspeaker quality is exceedingly difficult. The human ear often conveys to the brain an impression that it has heard certain sounds that may not have been present at all. In addition, the memory of the human brain for what it has heard is extremely short. For this reason, it is next to impossible to judge the relative quality of two loudspeakers if any appreciable time elapses between the hearing of one and the other. That's what makes it so difficult to decide whether your neighbor's loudspeaker sounds better or worse than your own unless you can hear them alternately on the same receiver.



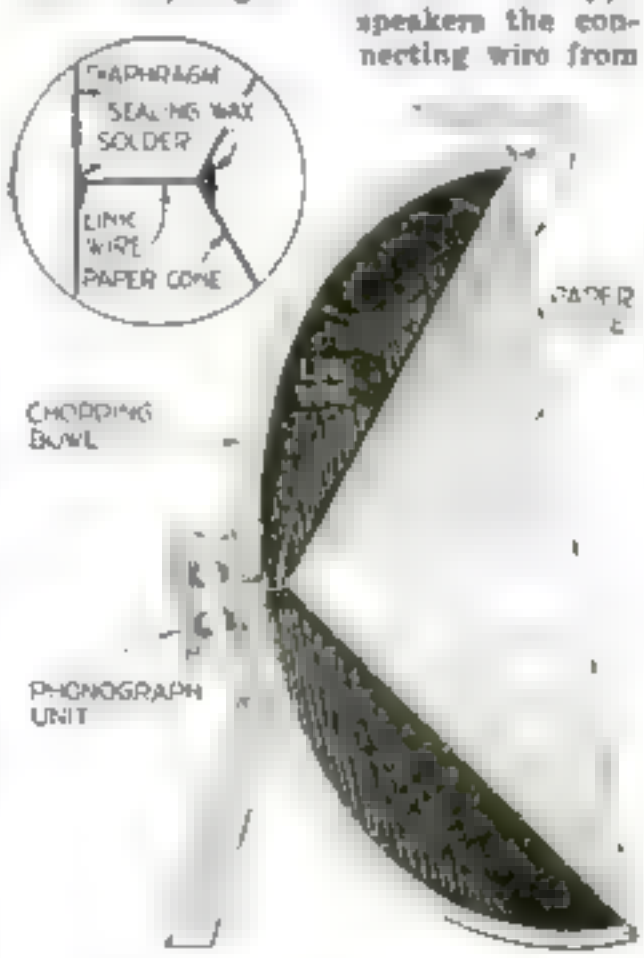
Clear Reception at Extremely Low Cost

The completed homemade loudspeaker constructed of a wrapping-paper cone, a chopping bowl, and a phonograph loudspeaker unit at a cost of only a few dollars. You don't have to be an expert mechanic to make a good job of it. Note how the paper cone is fastened to the rim of the bowl with thumbtacks

AFTER all, the true test of a loudspeaker is whether it pleases the man who has to listen to it, and on that basis you are just as good a judge as any one as to whether the loudspeaker you build is a good one or not

All loudspeakers consist, essentially, of two main parts. First there is the electrical mechanism for changing electrical oscillations into mechanical vibrations. Then there is always the part of the apparatus devoted to impressing these mechanical vibrations on the air so that they will be conveyed to your ear In the electrical end of the loudspeaker, a fine coil of wire is connected with the plate circuit of the last tube in the radio receiver and placed in the instrument where variations in the current flowing through the coil will change the magnetic pull of a permanent magnet. These changes, in turn, move the armature of the magnet back and forth.

In the simplest forms of loudspeaker, the armature consists of a thin disk of iron, and the vibrations of the iron set up sound waves in the air inside the horn. In others, the armature is a small piece of iron attached by wire to a mica diaphragm. In the cone-type speakers the connecting wire from the armature is fastened directly to the center of a paper cone



How the Parts Are Assembled

Constructional details of the loudspeaker. The larger diagram shows how the bowl, paper cone, and phonograph unit are assembled and connected. The smaller diagram shows how the link wire is soldered to the diaphragm and fastened to the cone by sealing wax

The homemade loudspeaker illustrated is a combination of the iron diaphragm and the paper cone types.

SPEECH, as reproduced by this homemade loudspeaker, is particularly distinct The *sh* and other sibilant sounds come hissing from the paper in fine style, and you can understand every syllable spoken by the person who is broadcasting.

The list of material you will need to build this loudspeaker is very brief. Here it is:

A—phonograph loudspeaker unit; *B*—wooden chopping bowl; *C*—paper cone; *D*—link wire; *E* and *F*—supporting legs, thumbtacks, sealing wax, etc.

The phonograph loudspeaker unit *A* used in the model loudspeaker was of a standard, adjustable type using a lacquered, metal diaphragm. Any of the standard units can be used at *A* and if you cannot secure the adjustable type, a non-adjustable unit will give good results. It is also possible to use one of a pair of head phones.

The wooden chopping bowl *B* should be of the largest size obtainable from your local hardware and house-furnishing store. The one used in making the loudspeaker shown in the illustrations cost 69 cents.

The paper cone *C* is made out of heavy brown wrapping paper. Thin paper can be used, but will not give as good results as the heavy stuff

THE link wire *D* should be a piece of bare copper or brass wire not larger than No. 18 gage. Although copper wire is not very stiff, it seems to work well enough at this point, because it is so short that there is no tendency for it to bend out of shape.

The first step in constructing the loudspeaker, after you have all the parts, is to study the loudspeaker unit and find out how to take it apart so that you can get at the diaphragm. In some units, removing the diaphragm is only a matter of screwing off the cap, but in other styles the diaphragm is tightly clamped between two rings, and the cup containing the pole pieces and coils is made so that it can be moved back and forth with relation to the diaphragm.

At any rate, do your investigating

with the greatest care so as not to injure any of the parts. Do the work on a clean spot on your bench so that there will be no chance for dirt or small particles of steel or iron to get into the inside of the loudspeaker unit. Steel or iron particles are to be avoided particularly, because they stick to the ends of the pole pieces and jam between them and the diaphragm, seriously interfering with the operation of the unit. Do not try to pry the diaphragm away from the pole pieces, as this proceeding will result almost surely in bending the diaphragm. Slide it off sidewise as carefully as you can.

AFTER you have the diaphragm out of the unit, scrape off the shiny black lacquer from a spot about a quarter of an inch in diameter in the exact center. The best way to do this is to use a sharp knife, with the metal disk placed flat on a clean, smooth piece of board. Do not use too much pressure on the knife, since this may result in putting a dent in the center of the diaphragm. Of course, the spot must be scraped on the side of the diaphragm away from the pole pieces. If the diaphragm of the loudspeaker unit is of the bright, tinned variety, no scraping will be necessary, for the solder will flow onto the tinned surface.

The next step is to solder the link wire *D* to the bare spot. Iron is not the easiest material in the world to make solder stick to, but you will have little difficulty if you use a hot iron and plenty of soldering paste. The excess paste can be wiped off afterward, of course. Leave the link wire several inches longer than necessary. It will be easier to hold while you are doing the soldering and it can be cut off to the proper length later on. Be sure that the wire is as straight as possible. Also, the solder joint will be much stronger if you bend about an eighth inch of the wire at right angles so that the solder will have a greater surface to hold.

Loudspeaker units for use on phonographs usually are made with a projection on the front that fits into the end of the tone arm of the phonograph. Through the center of the wooden chopping bowl *B*, bore a hole somewhat larger than the diameter of this projection so that the unit can be clamped flat against the back of the bowl as shown in the diagram on page 60. It really makes no difference what size the hole is, so long as it permits the projection of the loudspeaker to fit through it easily. The unit *A* used in the loudspeaker illustrated was fastened to the back of the chopping bowl by replacing two of the screws used to hold the diaphragm cover in place with long screws that projected through two holes drilled through the chopping bowl. Nuts turned down on these screws held the unit rigidly.

If the unit you purchase is not constructed in this way, or you use one of a pair of head phones, a satisfactory method will be to shape up a clamp of thin brass that can be bolted to the chopping bowl.

Clamp the unit *A* in place on the back of the bowl *B* and you will be ready to prepare the paper diaphragm *C*. This is a much simpler job than would appear at first glance. All you need to do is to cut out a circle of paper considerably larger than the diameter of the rim of the chopping bowl. Then, with the scissors, make a straight cut from the edge of the circle to the center. Be sure to use paper that has not been folded, since the creases make it difficult to form a smooth cone.

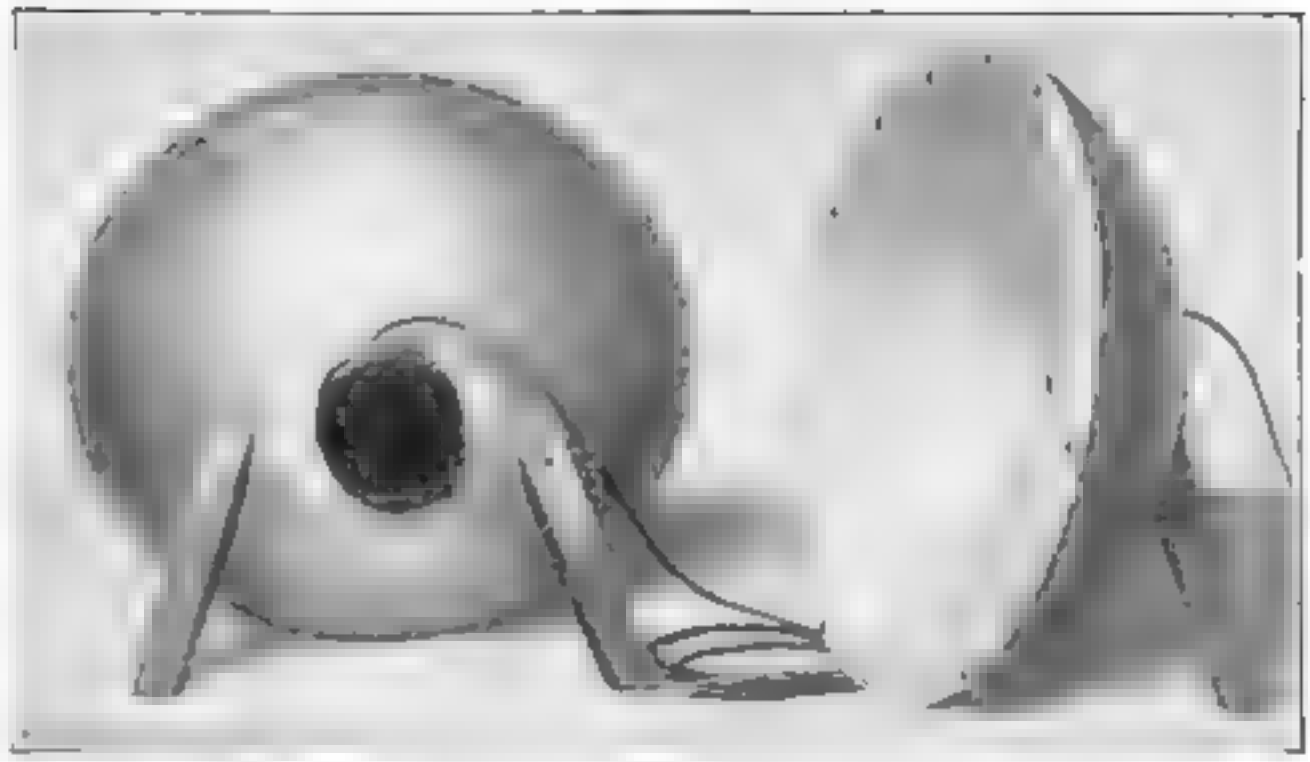
NOW lay the paper circle over the chopping bowl and push down on the center. It will form into a smooth cone shape as the center is depressed, and the edges of the paper will overlap where you cut to the center. The point of the cone should project down in the chopping bowl to within an inch of the bottom. The wire from the diaphragm can be allowed to project through the center of the paper. Cut off the wire within an inch of the paper. Mark off where the edge of the bowl is on the paper, then remove the paper so that you can cut with scissors around the circle you have marked. Next bend over about an eighth of an inch of the link wire at right angles, being careful to keep the rest of the wire straight. Replace the paper cone in the same position it had when you marked off the circle and, after making sure that the point of the cone is centered exactly over the middle of the diaphragm, use thumbtacks to fasten the edge of the paper to the rim of the chopping bowl.

HEAT the end of a stick of sealing wax with a match and let about two drops fall into the point of the cone so that the bent end of the wire is covered with the wax. Be sure that the wax is good and hot so that it will stick to the paper properly. After that you can put a drop or two along the joint in the paper as shown. This will prevent vibration.

This completes the work on the loudspeaker, and all that remains is to fit the two support legs *E* and *F*. As shown in the illustrations, these are simply sticks of wood cut to right length and beveled.

Satisfactory loudspeaker units can be purchased for about five or six dollars. The tone and volume obtainable will depend to a large extent, of course, on the qualities of the unit. The rest of the material should not cost over a dollar and results certainly will be worth while.

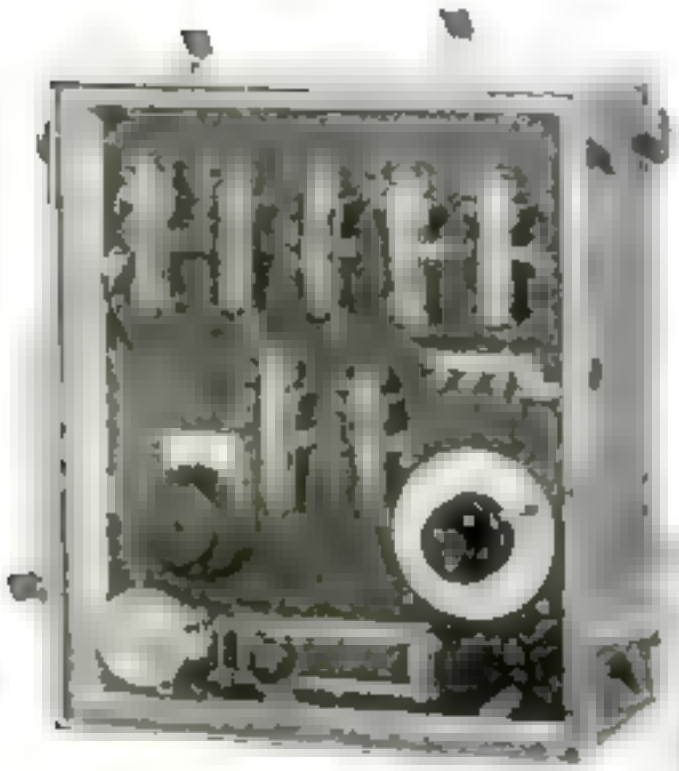
SOME of our readers may wish to know why the paper is formed into a cone shape rather than fastened in a flat sheet across the rim of the bowl. There are two reasons. One is that the cone shape makes possible a short link wire. This is an advantage, since a long, heavy wire would act as a damper and cut down the volume considerably. The other reason is that the restricted air space between the paper cone and the inside of the chopping bowl helps to keep the paper diaphragm from blasting on the high notes, a trouble that is not met with in the factory-made paper-cone speakers, because the electrical units used are built to overcome it.



Surprisingly Simple to Build, It Gives Good Results

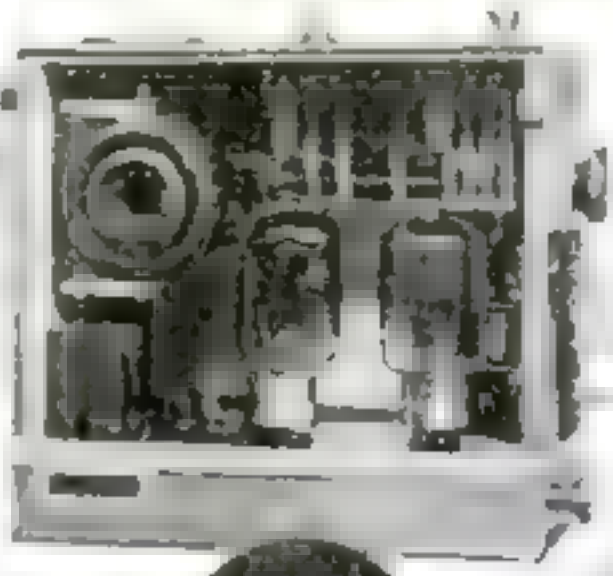
Two views of the paper cone-chopping bowl speaker. Notice the way in which the phonograph unit is attached to the back of the bowl also how the supporting legs are attached. The legs are simply sticks of wood cut to the right length and beveled. The tone and volume of the speaker of course, will depend largely on the qualities of the phonograph unit used with it

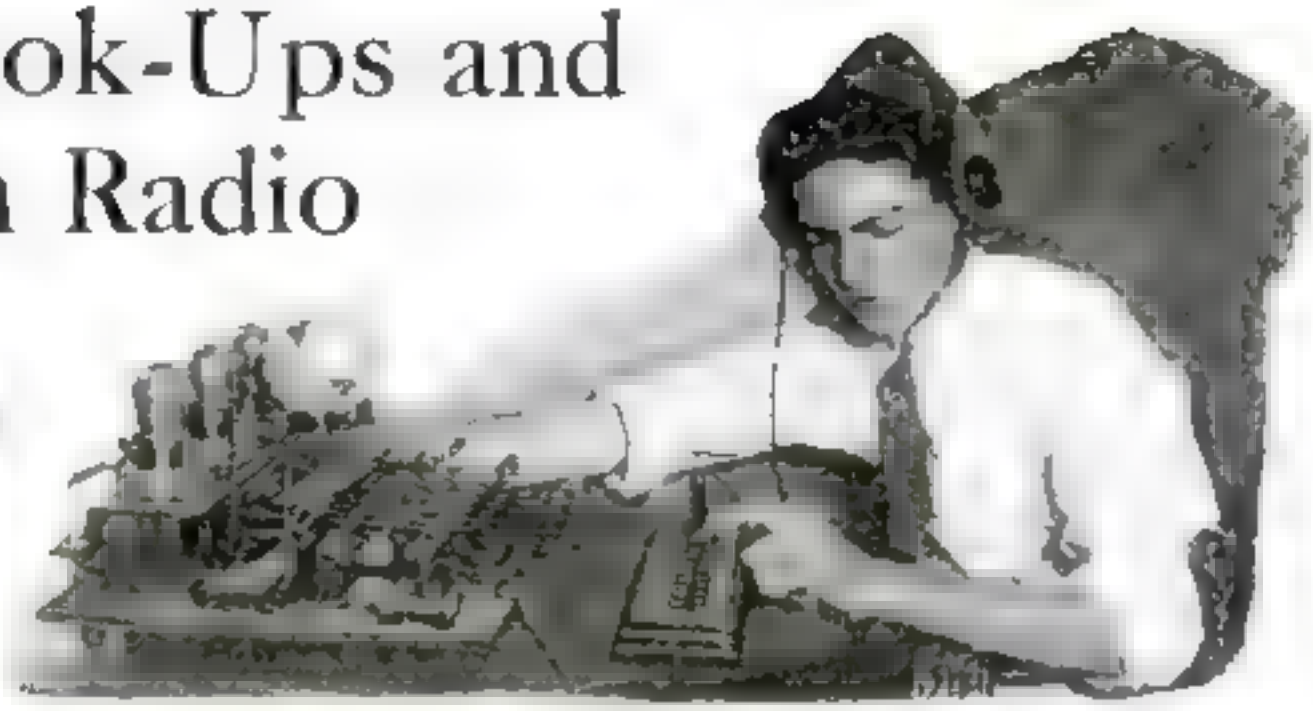
Unusual Hook-Ups and Ideas in Radio



New Airplane Radio Set

Above is a very compact radio receiver designed for use on British fighting airplanes. At the right is the vacuum tube transmitter. The wave range of the outfit is from 75 to 140 meters. Its communication range is approximately three miles, sufficient to enable all units in flying formation, as well as squadrons, to keep in perfect liaison. The complete outfit weighs 67 pounds



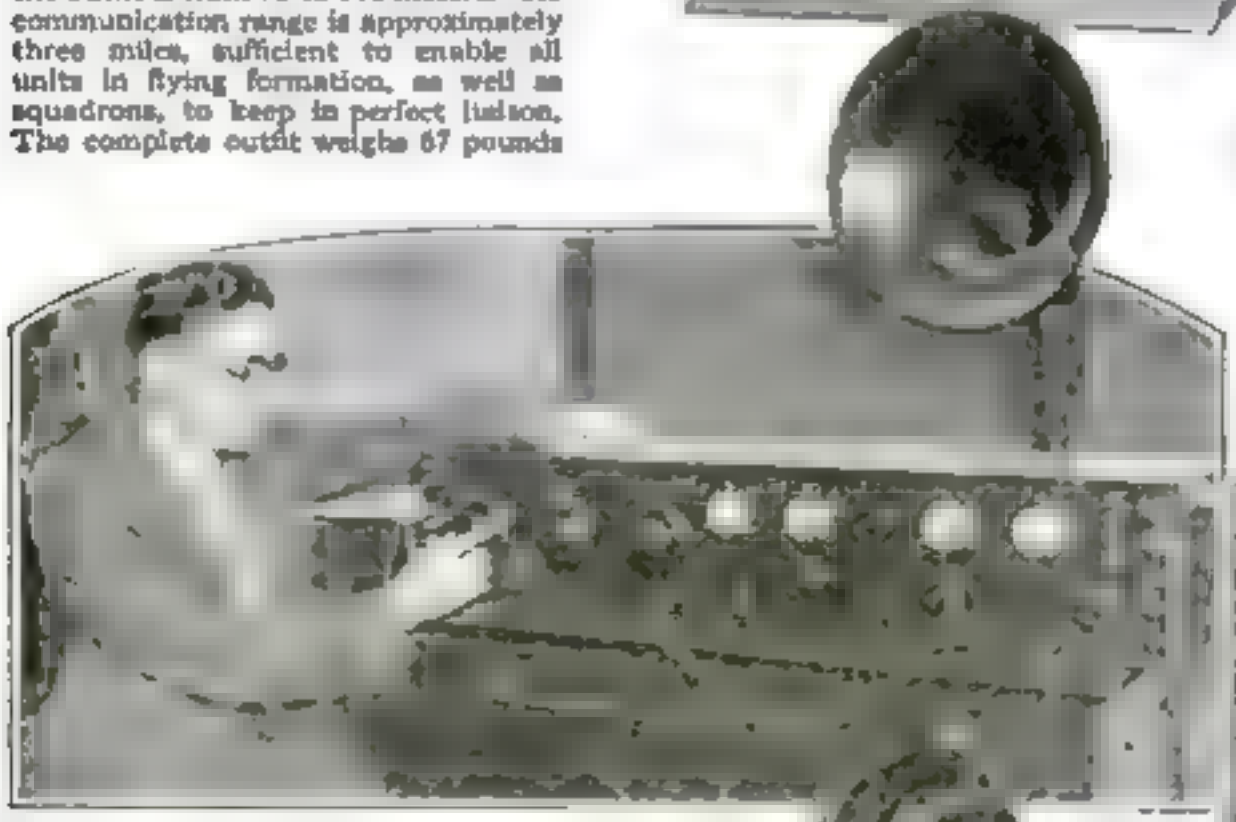


Tuned by Pushbuttons

In this receiver, built by John J. Muller, electromagnets are connected with pushbuttons so that a push on any button instantly tunes the set to the station whose letters are on that button

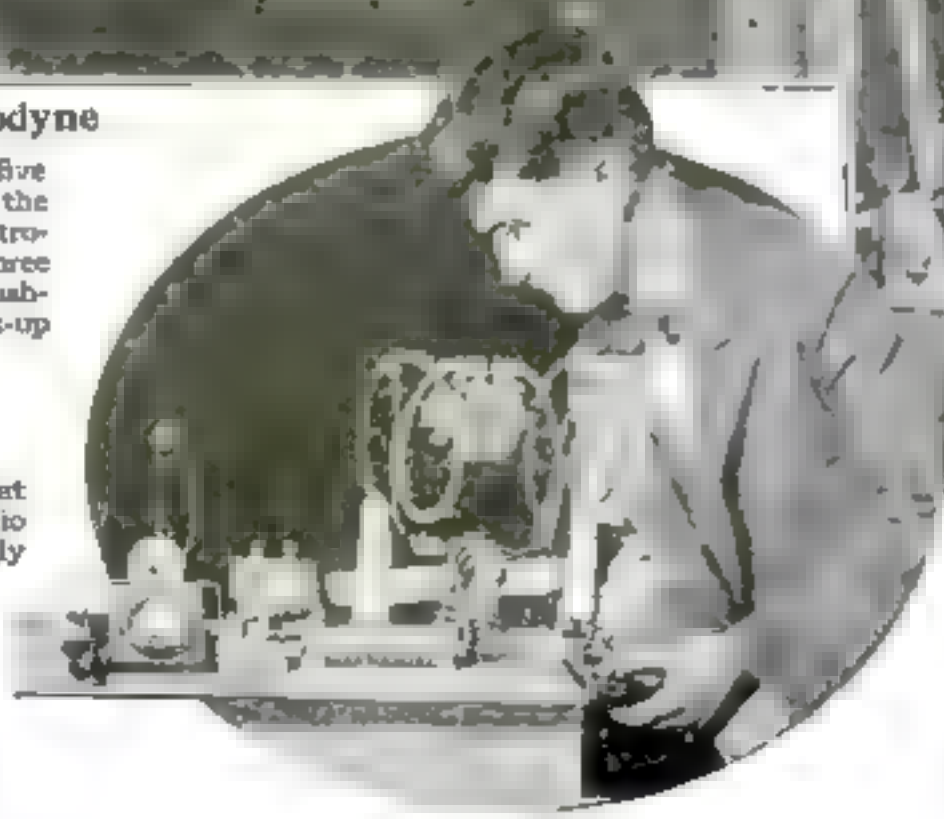
Revolving Top Tunes It

Instead of turning dials, you tune this receiver by revolving the top, on the edge of which is space to write the names of stations. It employs five tubes in a tuned radio-frequency circuit and will operate a speaker



Eight-Tube Neutrodyne

In addition to the usual five tubes, George Tolley, the builder of this giant neutrodyne, has incorporated three extra tubes in a special push-pull power amplifier hook-up



A One-Meter Transmitter

Here is a transmitter that actually will transmit radio waves on the astonishingly short wave length of one meter. For such high-frequency work, great care is necessary to eliminate all possible capacity from the circuit and to keep the connecting wires short

He Spoke from the Arctic

John L. Reinartz, radio operator, of the *Bowdoin*, the MacMillan Arctic Expedition ship. During almost the entire polar trip he kept in touch with amateur operators all over the United States, by using a special short-wave apparatus

What 10,000,000 People Like to Hear on the Radio

How Broadcasters Select Programs to Fit Your Taste

By John E. Lodge

Which Feature Do *You* Like Best?

SINCE the beginning of broadcasting, studio managers have been studying the wishes of the radio audience with the idea of presenting features that will please the greatest possible number of people. The half-dozen sketches above illustrate familiar radio features in the order of their popularity, as indicated by letters received from fans. First come big sporting events—boxing matches, the world series, football games. Jazz music is next on the list, and classical music runs third. After-dinner speeches and similar events in which the element of humor is present is the fourth choice of the radio public. Then come morning exercises and lectures and talks

WHEN you plug in the loudspeaker and begin turning the dials on your radio set, what do you want to hear? Jazz? Speeches? Music? Sport? News?

Perhaps you have no particular desires in the matter; you just sample what several stations are offering, and at last settle back to enjoy some broadcast feature that happens to fit your mood.

Many radio fans are like that; and yet so diversified is the typical broadcast program of today that one need do very little "shopping" in the other before bringing in an acceptable feature. That is because the broadcast studio managers know exactly what you and 10,000,000 other radio listeners like to hear. They spend their time finding out what you want and trying to give it to you.

"How do you know what the listeners want?" I asked the manager of a pioneer broadcasting station.

"Well," he replied, "finding out just what our listeners want is quite a problem—there are so many of them. And it is still harder to get them what they want. For the radio audience is becoming more critical every day.

"In the early days of broadcasting, the mere novelty of the thing kept people interested. Our programs were mediocre—we couldn't get high class entertainers—and our transmission was not so good. But nobody cared. The listeners-in didn't expect real entertainment, and poor transmission didn't bother them at all. The ordinary radio receiver of those days would have reduced the best broadcasting to a mere raucous echo anyway. Just to be able to understand what the announcer was talking about was marvel enough for most radio fans, and getting distant stations meant a lot more than quality."

"But I understand that you received a lot of nice letters about those early programs," I reminded him.

"SURE thing!" he said. "The poorest number on one of our early programs was good for at least a basketful of mail. Most of the letters were from people who just wanted to brag about their new toy—the radio set. Nine-tenths of them wouldn't have wasted two minutes listening to such stuff if it had come to them by some other way than by radio!

"But that mail meant a lot to us," he continued. "You see, we were in need of encouragement. Broadcasting was just an experiment then, and the mail we received was the only evidence we had that anybody ever listened to our station.

"HOWEVER, the experimental days are about over now. We know definitely that any station that goes on the air with a good program will have plenty of listeners. We still get letters, though, and we want them. They help us keep our finger on the pulse of public likes and dislikes and so arrange our schedules that every listener will find at least one feature on each program to his liking.

"Another important end that fan mail serves nowadays is in supplying moral support to the radio artists. Most of them cannot visualize the vastness of their silent audience. The average listener has no conception of the feeling of hopeless futility that seizes the broadcasting artist the first time he faces the microphone. Letters, though, make the audience tangible to him, and the next time the artist appears, he is at ease and confident, because the performance is unconsciously directed to the writers of the letters."

"What is the most popular feature on your radio program?" I inquired of another prominent studio director.

"THAT'S easy to answer," he said, "if you will permit me to answer it for the city man and the farmer separately. By all odds, the most popular numbers on our program as far as the city man is concerned are the reports of sporting events such as boxing matches, the baseball world series, and the big college football games. Next come the reports of big news events such as political conventions. Popular music is third; then comes classical music; after that, after-dinner speeches, political debates, and similar events. Lectures and talks of a more or less serious nature, unless they are on some subject much in the popular mind at the moment, are last on the list.

A Prima Donna at the "Mike"

Public taste in music has improved most remarkably in the last two years, say radio station managers. Above is shown Madame Frances Alda, famous prima donna of the Metropolitan Opera Company, at a recent radio appearance that scored a decided hit

"As for the farmer, the weather and crop reports overshadow everything else that he hears over the air. This is understandable, of course, since accurate weather and crop news mean dollars in the farmer's pocket.

"A really remarkable change has come in public taste in the last two years in connection with music. Jazz used to be the only kind of music the radio audience would listen to, so much so, in fact, that every time we ran through an evening without a whole lot of jazz music and popular songs, we'd be swamped with hot letters from listeners complaining against what they called 'highbrow' music.

Your "Radio Eyes" at the Football Game

A football game or other sport event of national importance pleases the largest number of radio listeners. Here are Graham McNamee (with glasses) and Phillips Carlin (at microphone) announcers of Station WEAF describing the Army-Notre Dame football game at New York City

"JAZZ dance music is still more popular than anything else in the musical line, but there has been a decided shift in the listening public's taste toward classical music, especially stringed instruments, symphony orchestras and really high class vocal selections. A few weeks ago our program for an entire day had no jazz features, yet the fan mail was just about as large and favorable as if we had given nothing but jazz music.

"And, of course, every one knows of the tremendous response that greeted the broadcasting, last season, of prominent grand opera and concert stars by way of a whole chain of stations. A phonograph company put on the programs and it is said that more than 150,000 records were sold as a direct result of one song by a well known artist.

"This season broadcasting by opera and concert stars under the auspices of a large radio company is meeting with a similar enthusiastic response."

Several other studio directors mentioned this trend of public taste in the direction of high class music. Most of them seemed unable to account for the change. One director, though, had very definite ideas on the subject.

"Why," I asked him, "are radio fans acquiring a taste for good music?"

"THAT'S easy," he replied. "Before the days of radio, millions of people never had heard enough good music to become familiar with it and learn to like it. Radio actually is educating them to demand good music. Wait a minute—" he broke off while he thumbed over a mass of letters in a special file beside his desk.

"Here you are," he said. "This ought to show what I am driving at. These two letters are from the same man. You will note by the dates that they were written two years apart. In his second letter he mentioned the fact that he had written before, and I looked up his first letter out of curiosity. Now I am glad I did."

Here are extracts from the two letters. The first was written in January, 1923, and the second, November, 1925

The program from your station was received here last night with great clearness and lots of volume and it was enjoyed by my family as well as several guests. We all join in thanking you for the entertainment you have afforded us. Every word of the announcer could be understood. "Somebody's Wrong" and "Tennessee" were great. That is sure some music! Give us more like that and lay off the classical stuff. It is all right for those who like it, but nobody around here does at any rate.

And the second one:

Please give my best wishes to T—— S—— His violin selections last night were wonderful. My new cone-type loudspeaker seems to be particularly good on the violin pieces. I enjoyed the "Grand Opera Hour" on Thursday immensely, and hope this will be made a regular feature.

Radio Fans Insist on the Best

No matter what the feature say the broadcasting managers, the radio audience insists these days that it be put over by an expert. That is why noted stage stars, such as Raymond Hitchcock (above), invariably please

"There's the answer in a nutshell," went on the studio director. "That man and millions more like him are developing real taste in music, and radio is responsible!"

A startling improvement in the general public's musical ear is not the only change that radio has brought. All jazz may be jazzy, but there are different ways of playing it, as some of the studio directors have found out. And the same thing applies to other popular features such as the latest sentimental love songs and comedy numbers.

"The job now is to supply really high class talent," said the studio director of one of the biggest stations.

"I NEVER heard of such a critical audience as the bunch of radio listeners who tune in on our programs. It seems to be easy enough to please them in the variety of selections. The jazz hounds like a little good music and a song now and then. And even musical critics can stand a bit of jazz dance music. But there is one sure thing—no matter what kind of a program you give them, they'll jump on your neck unless each feature is put over by an expert. The day of 'kerosene circuit' musicians and entertainers is strictly past as far as radio is concerned. Nobody but the headliners make a hit nowadays. And by headliners I mean those artists who really know how to sing or play, regardless of whether they already have made their reputation on the legitimate stage or in concert tours."

"What about the artists who refuse to broadcast on the ground that they will spoil the sale of their services for personal appearances?" I asked.

"If any artists want to stick to that idea, that's their privilege," he replied. "They are mistaken. Radio has put many artists' names on Broadway in white lights. Before broadcasting they were hard up to get any kind of dating. The fact that the radio public is so critical is known to the theatrical booking agents, and you may be sure they keep their eyes open for new artists who make big hits with the loudspeaker audience."

THE radio audience, some 10,000,000 strong, naturally represents a pretty thorough cross section of the American people. And among so many it is certainly possible to find a desire for every form of entertainment or instruction.

"We have had requests for almost everything under the sun," another studio manager said. "But just one letter asking for a certain feature doesn't mean that we will put it on the program. It's a matter of numbers with us. When several letters come in, all asking for the same or a similar feature, we sit up and take notice, and, if it is at all possible, the requested feature is placed on the program.

(Continued on page 144)

Novel Auto Fittings

Improved Tools and Handy Accessories for Motorists

Folding Tire Rim

Any motorist who has wrestled with the ordinary one-piece type of auto-tire rim will appreciate the advantages of a rim that is built in hinged sections so that it will collapse when a catch is released. It is claimed by the manufacturers that the strength of this folding type of rim is just as great as the standard types. As shown above, the tire can be removed from the rim without at all bending the rim

Whistle Signals Tire Puncture

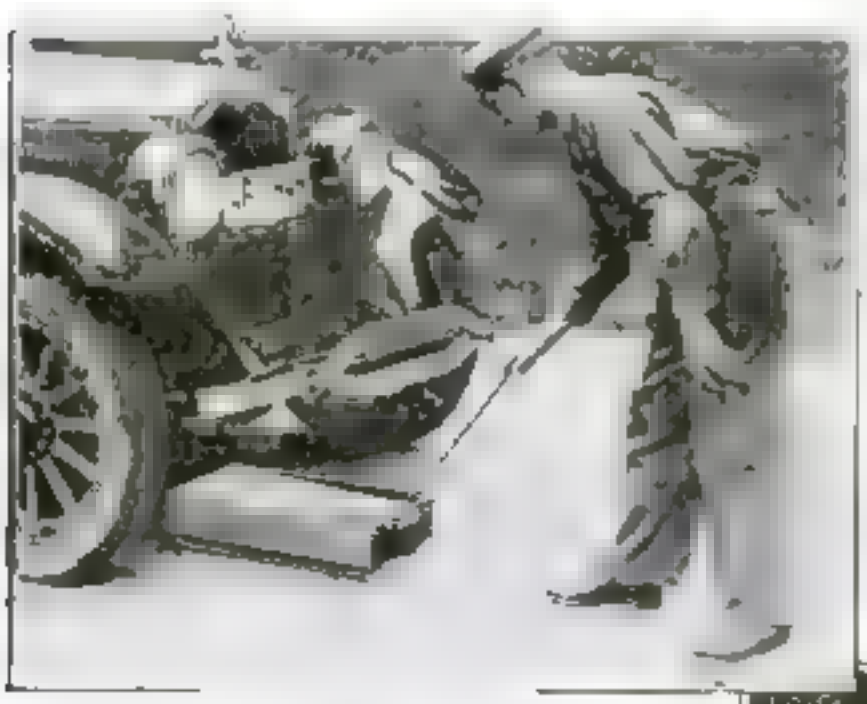
This remarkable device is screwed on the valve stem in place of the usual dustcap. When the tire is punctured, the whistle sounds a shrill note that continues until the device is turned off

Goggles for Night Driving

These goggles for the motorist are designed to reduce glare from approaching headlights. Fin-shaped projections cut off all light from the sides. They are cut low enough so that the wearer can obtain full vision above them

Spark-Plug Wrench

The swivel handle on the handy socket wrench pictured below makes it possible to get the spark plugs out with little effort



Brake-Band Reliner

Relining the brake bands on an automobile is a tedious and difficult job without the proper equipment. This novel machine can be mounted on the workbench in the garage It removes the old rivets and then punches, countersinks, and rivets the new brake lining in place

Electric Cigarette Lighter

Below is an electric cigarette lighter for the instrument board. The cigarette is inserted in a small tube. When the tube is raised, the cigarette end is quickly lighted against the heating element

Tank for Draining Crankcase

Most automobiles are built with the drain plug of the crankcase so close to the ground that it is impossible to get an ordinary pail underneath the plug when it becomes necessary to drain and refill the crankcase with new oil. This ingenious shallow tank with long flexible handle successfully solves the problem

Folding Wrench Set

This unique wrench is so constructed that the six individual sockets form into a nest that can be stowed away in the nine-inch handle. It fits hex nuts from one-half to seven-eighths inch. A seven-inch extension is included

"YOU don't have to be an expert to make the old bus shine like new," says Gus. "All you need is good brushes, good paint, and the right dustproof place to do the job."

In a dustproof corner of the Model Garage Gus demonstrates to Joe why a high grade brush is important if you expect to do a fine painting job. "A 39-cent barga n sale brush simply won't flow the paint on smoothly and you have to spend half your time picking off the bristles"

How to Paint Your Own Car

Gus Tells Why It Pays to Be Fussy about Dust and Your Brush

By Martin Bunn

"WHAT in blazes are you going to do with all that paint?" exclaimed Joe Clark, half owner of the Model Garage, to his partner as the latter pulled can after can out of his car and arranged them in a neat row on the workbench.

"Do you suppose I'm going to drink it?" Gus Wilson grumbled. "Read the labels on the cans if you're so durn curious!"

Joe stooped over to look at the labels more closely. "'Body Filler'—'Best Pigment Ground in Oil'—'Fine Coach Varnish'—" he read.

"I'm going to dol up this old bus so she looks like new," announced Gus. "Any objections?"

Joe smiled broadly. "It's a fine idea, all right. Your old boat looks like the moths have been making a meal out of it. But where did you get the notion that you're an auto painter? Takes an expert to do a good painting job. Just because you can fix the mechanical part of an automobile is no sign that you know how to paint the thing too. I'll bet it'll look like the dickens when you get through with it!"

"IS THAT so?" Gus growled scornfully. "Well, you just keep your eye on me now and you'll learn something."

He cast his eye appraisingly over a partly walled-in corner of the garage and then proceeded to pull out a large roll of cheap cotton cloth.

"You see, Joe, the first thing you have to figure on," Gus began, "is a place to do the job. That's more than half the battle because you can't do good painting in a cold, dusty room. I'm going to start by closing in that corner so I can work without you or the customers shuffling up a lot of dust all over the fresh paint. Tomorrow I'm going to bring down a couple of oil stoves to keep that corner good and warm so that the paint and varnish will flow easy and dry as quick as possible."

"HUMPH!" said Joe, rubbing his chin reflectively. "Maybe you do know what you're about, after all. Come on—I'll help you put up the dust wall before I get busy with those hills."

But there were interruptions in the form of emergency repair jobs, and it was two days before the last piece of cotton cloth was tacked into place and Gus was satisfied with the arrangement.

Gus always had been in the habit of keeping his car pretty clean as well as in perfect order mechanically, but as soon as the paint room was complete he set to work to give the machine a washing so thorough that it was not finished until every speck of grease and mud had been removed from the body and running gear.

"There you are," said Gus with satisfaction. "That car is what you could call chemically pure! If you can find any dirt on that boat, Joe, I'll eat every grain of it."

"I kind of hoped I wouldn't have to take off the old paint, but now that I have it perfectly clean, I notice that it is checked and cracked in a lot of places. There are some spots, too, where the paint has chipped off and rust has started. I guess I might as well begin at the beginning and take all the paint off, right down to the bare metal."

"Phew!" gasped Joe a few minutes later as he came coughing out of his little office. "That's a gosh-awful smell you're making, Gus! What brand of paint remover is that? I never smelt anything so rank."

"You'll get used to it," grunted Gus. "I mixed it myself—half benzol and half acetone. It is kind of whiffy, I'll admit; but if you leave it on for about an hour, you can rub the paint off with an old rag or scrape it off with a putty knife."

By the next night Gus had removed the paint down to the bare wood and metal. Then he went over the car with steel wool and fine sandpaper, scraping the rust spots until the surface was smooth and even. After that he dusted it off with a piece of cheesecloth on which a few drops of varnish had been poured. This he allowed to dry till it became tacky. This process removed even the invisible dust, so Gus said.

"YOU see, Joe," he remarked, standing back and regarding his work with pride, "there's one sure thing about painting. You can't do a good job unless you put the paint on the right kind of a surface. One oily spot, or even a greasy finger mark, may cause the paint to peel off a few months later and ruin the whole job. And now I'm ready to put on the priming coat," he concluded as he busied himself with his array of cans.

"Gosh!" exclaimed Joe. "Looks as though you were setting out to do a real honest-to-goodness professional job—about 17 coats of paint."

"Not as many as that," Gus replied. "Four coats will be all that I'll have time

(Continued on page 145)

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Useful Hints for Car Owners

A Novel Patch Press—Simple Remedies for Motoring Troubles

ALMOST important point in making puncture repairs with cemented patches is to use plenty of pressure on the patch while the cement is setting. A short piece of board carried in the tool-kit will permit you to use your regular jack, as shown in Fig. 1, to clamp the tube and patch against the under side of the runningboard

If your car is fitted with running-boards made of corrugated metal, it will, of course, be necessary to use two boards, placing the second board between the underside of the runningboard and the tube surface

Fig. 1. How a jack and small board can be used against the runningboard to exert pressure on a tire patch until it is secure

THE gasoline pipe frequently gets clogged up between the main tank and the vacuum tank or, if there is no vacuum tank on the car, between the main tank and the carburetor When this happens, it sometimes is difficult to clear out the obstruction without taking the whole pipe out of the car and attaching it to the air-pressure line.

For this reason it is a good idea to fit a petcock in the pipe line between the main tank and the vacuum tank, as shown in Fig. 2. Then, when the pipe gets clogged, the compressed-air connection can be made to the petcock. With the pipe disconnected at first one end and then the other, the obstruction quickly is blown out.

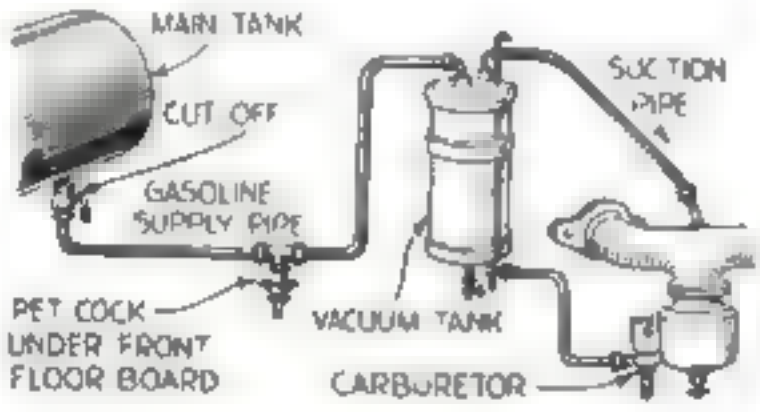


Fig. 2. A petcock fitted in gasoline pipe line between main tank and vacuum tank aids in clearing out an obstruction when the pipe gets clogged. A compressed air connection can be made to the petcock and the obstruction blown out with little effort

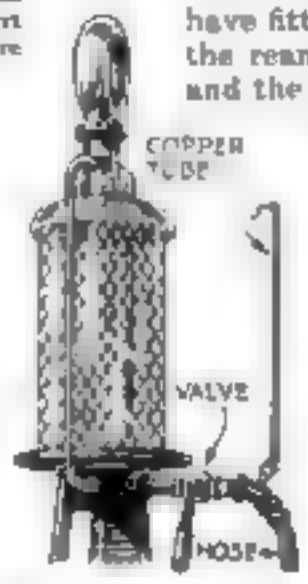


Fig. 3. A vent pipe at the outlet of gasoline pump aids in emptying the supply pipe quickly

CERTAIN types of visible gasoline pumps are not provided with a relief valve at the upper end of the discharge hose. This greatly delays the emptying of the hose after the gasoline has flowed out of the measuring compartment.

A cure for this trouble is a vent pipe arranged as shown in Fig. 3. It consists of a length of one-eighth-inch pipe connected with the supply pipe at the point where it leaves the measuring compartment. The open end of the pipe is carried up above the top level of the gasoline in the measuring compartment so that there will be no chance for gasoline to come out at this point.

When the measuring tank is empty, air rushes into the vent pipe and causes the gasoline in the supply pipe to run quickly into the motor's tank

POOR connections at the storage-battery terminals often are responsible for trouble in the operation of the car

Occasionally the trouble is caused by wear. If your terminals are of the plug type, a good way to tighten them when they are worn so loose that the nut fails to draw them up tightly, is to fit a lead sleeve over the plug, as illustrated in Fig. 4. Clamp terminals can be tightened by slotting the post on the battery with a hacksaw and screwing a brass screw into the slot after the terminal has been bolted into place.

Fig. 4. Above Clamp-type battery terminal tightened with brass screw Below Plug terminal tightened with a lead sleeve

BADLY fitted bearings cause almost as much motor trouble as poor quality oil or scanty lubrication. One point in the automobile motor that deserves careful attention is the wristpin bearing. Owners who overhaul their own cars frequently make a serious mistake in attempting to ream out the new bushings they have fitted to the pistons. They run the reamer through from each side, and the result is often as pictured in the upper illustration of Fig. 5.

A bushing fitted in this way will bind badly for a while and then will become so loose that a terrific noise results when the motor is started. The correct way to ream wristpin bushings is to replace one bushing and then run the reamer through the new bushing by way of the old one on the other side, as shown in the lower illustration. Then the latter is replaced and the process is repeated in the other direction. Theoretically, a reamer should follow the hole, but good results only can be obtained if the reamer is guided properly. Too stiff steering often is due to crooked reaming.

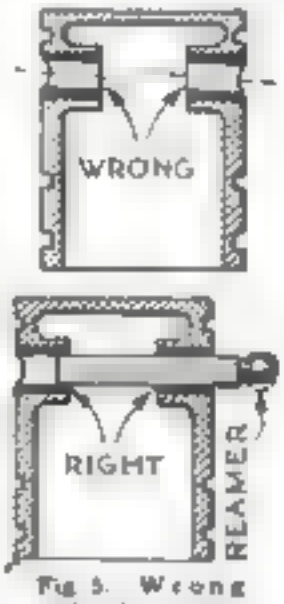


Fig. 5. Wrong and right ways to ream bushings in wristpin bearings

MOTORISTS frequently so miscalculate the clearance in driving into the garage that the rear fender or hub cap always scrapes against the door. A simple remedy is to take some pieces of heavy pipe, and after flattening and bending the ends, fasten them at the door corners as shown in Fig. 6. They should be set at about a 45-degree angle. Then when you drive too close, the tire rides up on the pipe and slides the car away from the door so that the fender does not touch.

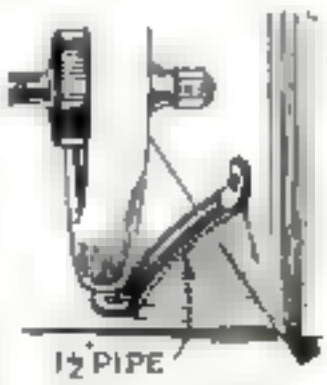


Fig. 6. Heavy pipe (lettered) across corners prevents the car scraping the garage door

WHEN a vertical tube, fin type radiator becomes frozen or is damaged through collision or fan bracket breakage, leaks develop in a number of tubes. The best way to repair such an outfit is to eliminate the damaged tubes.

As shown in Fig. 7, the fins are pushed up and down until you can get at the burst tubes. These are cut off at each side of the break with a saw made out of a short piece of hacksaw blade fitted to a wooden handle. Then the ends of the tubes are squeezed flat with a pair of pliers and tightly closed by soldering. After that the fins can be pulled back into place.

If the job is carefully done, the damaged area will not be noticeable.

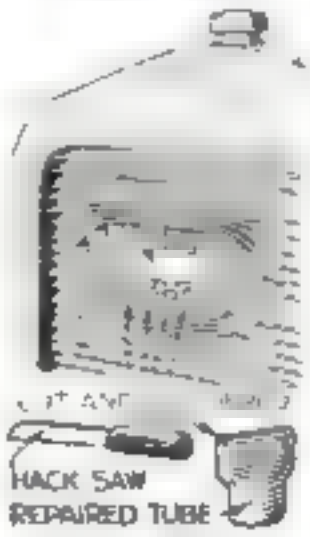


Fig. 7. Radiator repaired by cutting and soldering tubes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BUCKINGHAM
DERESNADYNE
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PFANSTIEHL
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Standard on the finest
THORDARSON
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AMPLIFYING TRANSFORMERS
THORDARSON ELECTRIC MANUFACTURING CO. Chicago U.S.A.
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
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MERCURY
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HOWARD
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EVEREADY ®
No. 779

A large vertical 22½-volt "B" Battery

THE famous Eveready "B" Battery No. 766, horizontal, now has a vertical brother, No. 779, 22½ volts. This has the same large cells as the No. 766, and will last as long in equal service. Being vertical, it fits perfectly the battery compartments of many popular receivers. Also valuable for use where the table or shelf space is limited.

Manufactured and guaranteed by

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EVEREADY HOUR BATTERY TUESDAY at 9 P.M.

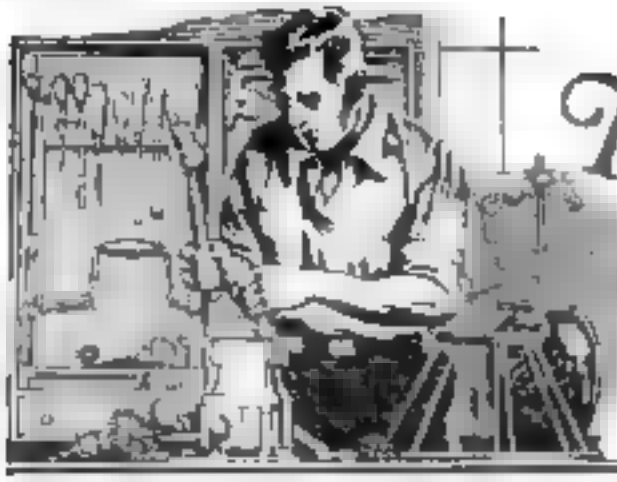
WEAF WFI WWJ

WJAR WCCO

WTAG WDC

EVEREADY
Radio Batteries
—they last longer

 See page 6.



The Home Workshop

Arthur Wakeling, *Editor*

Gumption *with* Tools

By Daniel C. Beard

National Scout Commissioner, Boy Scouts of America

YOU will not hesitate to undertake any job in your home workshop after reading this article by Dan Beard. If you ever do have a moment of doubt, all you will need to do is to look at your kit of tools—your hammers, saws, planes, chisels, pliers, files, and all the other splendid examples of the toolmaker's art—and ask yourself "What wonderful things couldn't a Dan Beard do with these tools!" Take the tools you have or those you can buy at the corner hardware store and use them with a little of the "gumption" Dan Beard describes, and you will find your home workshop will become a place of real accomplishment.

IN THE beautiful land of yesterday, when the writer and his compatriots were barefooted boys, perhaps none of us was rich enough to own a chest of tools; at any rate, none of us did

The writer can well remember when his older brother gave him a gouge or half-round chisel. That gouge he used for everything except for pulling tacks. With it he made model sailboats of blocks of wood; with it he engraved his name upon all the beech trees within the circuit of eight or 10 miles from his home. He cannot now remember all the uses to which that gouge was put; but it was the only real carpenter's tool he possessed and he used it upon almost every occasion, as a half-moon scar still testifies

What he most desired, however, was a drawknife. Alas! he never owned one; so he wrapped a rag around the pointed end of a butcher knife that he might grasp it with no danger of wounding his hand. Then, using the real handle for his other hand, he found that it was not a bad substitute for a drawknife. With this crude tool he fashioned some very shapely and effective shinny sticks and bows. With bits of broken window-pane glass or fragments of flint he smoothed the surface of his bows and arrows

WHEN the boys of yesterday needed an awl, they did not go to the hardware store for it, because in those days boys were not supplied with a surplus of money; but they made their awls of turkey bone, hardening the bone by holding it over the hot coals until all the grease melted out, after which it was sharpened like an awl Or, they took an ordinary "cut nail," there being no wire nails in those days, and rubbed it on the stone front steps until its edges were rounded off, and then gave it a sharp point.

Next, the head of the nail was removed, either by slowly and painfully grinding it on a stone until it was worn off, or by using an old hatchet and resting its edge on the nail close up to the head and hammering the head of the hatchet with stone until the blade severed the head from the nail. In this way they made an awl, and when it was fitted into a wooden handle, it was an excellent tool. We used the awl for a leather punch and for various other purposes, as the occasion suggested.

As a rule we could borrow a saw with which to saw boards, or make a saw of a big kitchen knife by nicking it along its edge

When we could not secure a saw, we cut the boards off with the axe or hatchet with which all woodsheds were furnished. We first drew a line across them from side to side, then placed the edge of the axe or hatchet on the line and hammered them with some heavy implement. By this means we gradually made a deep groove all the way across the board. Turning the board over we made another similar groove upon the opposite side, corresponding exactly in location with the first one. By carefully deepening these grooves we at last got the board so thin at that point that we could break it off with no danger of splitting; then we would take the edge of the sharp axe or hatchet and with it shave the rough edge of the board until it was smooth

Dan Beard, chief of the Boy Scouts, at 75, making a bow just as he described in "The American Boy's Handy Book," which was published in 1882

IN MY log house at Pike County, Pa., now used as the executive office of my School of the Outdoors, I have a substantial table, which we made entirely with no implement but an axe. The boards that serve for the top were cut the proper length as just described. I sometimes think that our multiplication of tools of today and our easy access to them make work so simple for us that it tends to dull our inventive power and in a measure atrophies our resourcefulness.

The old woodsman could build a good house and furnish it without a nail or spike or any hardware whatsoever and with no tools but his axe. Give such a man an axe, a big two-hand

(Continued on page 95)

How *We Made* a Winged Toboggan

Wings fitted to a toboggan add immeasurable thrills to the sport of coasting

FROM the extraordinarily graphic pen of a New York mining engineer comes this actual record of winged tobogganing at the Sunnyside Mine, near Silverton, Colo. The altitude of this mining camp is 12,500 feet above sea level, and the winters there are from September first to July first. Snow usually falls even in July and August. The author was the chief engineer and Harley Tryon the timekeeper at this mine.

By Paul H. Keating, E.M.

PLAYING and racing with death down a 1000-foot slope of frozen snow and ice may not appeal to some as a pastime, but the galling monotony of life in a Colorado mining camp, up on the Continental Divide, where the snow is 60 feet deep and the mercury is below zero for months, makes life seem very drab. Anything with a kick in it is welcome—anything.

Two of us, Harley Tryon and myself, were the charter and sole members of the Suicide Club, builders and operators of the only amusement device of its kind ever recorded, the toboggoplane.

Tobogganing is not a slow sport in itself, but like other speed sports, each descent must be a little faster, go a little farther than the preceding, or it loses its thrill.

A toboggan on a hard frozen crust will develop a speed greater than free fall in a given vertical distance, for much the same reason that an ice boat can go much faster than the wind that drives it. It takes longer for the given vertical distance to be covered, but at the end, the actual speed down the slope is greater. The "why of" this is out of place here, but it's true.

So, when I say that we hit the bottom of the hill going more than 200 miles an hour, I know the speed is underestimated. But even this palled after a time. Keeping a toboggan upright is much like riding a bicycle, or balancing a canoe, for at high speeds a very small irregularity on the surface can have disastrous effects. Our instruction from Old Man Experience on this point came in sudden and enormous doses. But in a short time there wasn't a hill around the camp that could offer a "kick." We could ride them all to a standstill.

ONE night, after a somewhat dull toboggan party, the idea was suggested to build a set of wings on the toboggan. Maybe it would fly!

I suggested it, and Tryon said, "If you'll build it, I'll ride the thing."

From the carpenter shop next afternoon I obtained some strips of pine, some muslin (used for wrapping ventilating pipe), and some piano wire. The toboggan itself was of standard design, 18 in. wide, 9 ft. long, with a curl in front 9 in. high.

The wings of the *Dragonfly*, as we later christened the toboggan, were made of a framework of knot-free pine strips, covered with muslin, which was painted with hot paraffin to make the fabric airtight.

Two strips 1 by 2½ in. and 11 ft. long were fastened together by four crosspieces 1 by 2½ in. by 4 ft. 2 in. Notches or mortises were cut in the longer strips to take the shorter ones, as illustrated, and a single sixpenny nail was driven into each joint from the outside.

The frame was laid on a floor and trued up with a steel square. Piano wire, about No. 22 gage, was then strung as indicated and drawn very tightly around each crosspiece and diagonally across each section of the wing. Shingle nails driven into the strips served to anchor the wires.

Each cross length was drawn until all gave approximately the same hum when picked. The diagonal wires also were adjusted to the same pitch by putting a lock washer around the intersection and drawing it by a wire toward the back of the frame until the tone of the wires was about even.

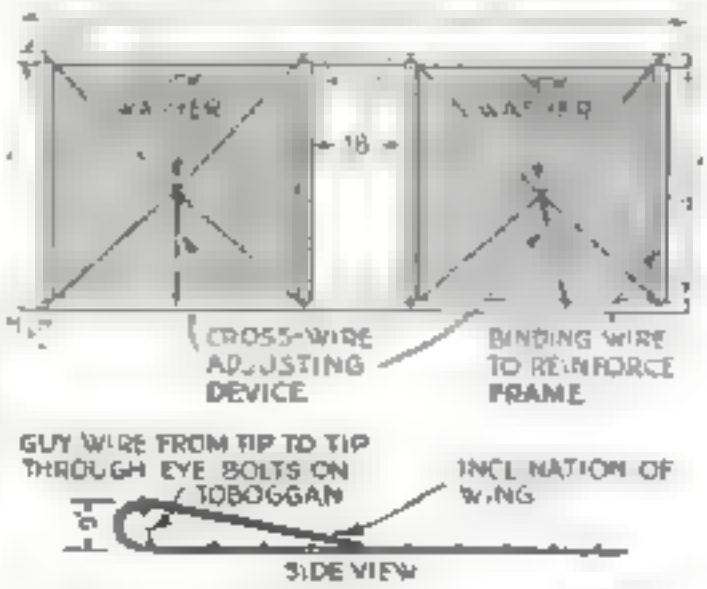
ORDINARY unbleached muslin was stretched over the entire frame, fastened every 2 in. with carpet tacks. The center or "cockpit" then was cut out and the loose edges tacked down. After prying the frame from the floor, to which it had been lightly nailed during the truing-up process, the muslin was painted with very hot paraffin.

Two holes were drilled in the top of the curl of the toboggan 1 ft. apart, and three turns of ordinary baling wire held the wings in place along the leading edge.

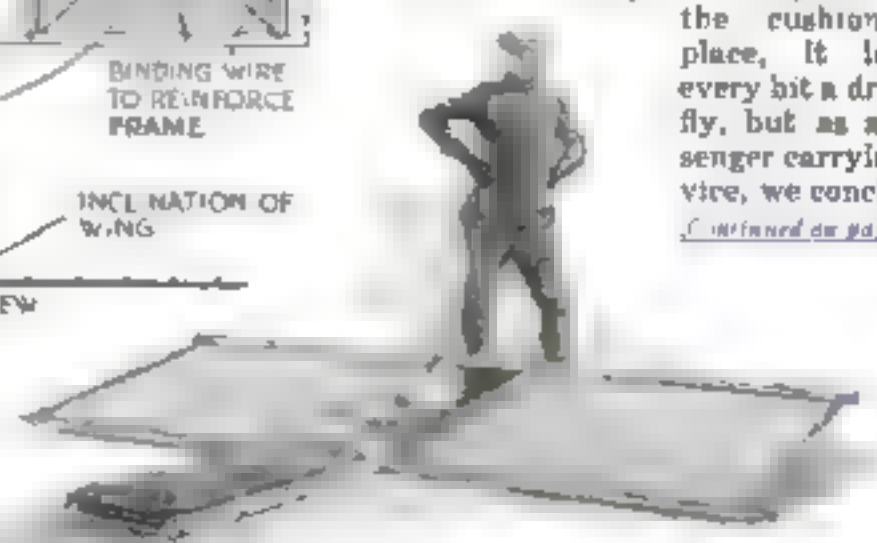
The rear edge was fastened similarly to the iron eyebolts along the side of the toboggan. A continuous guy of piano wire was strung from the front tip of one wing through eyebolts in the floor of the sled to the other wing tip, and drawn tight.

The next thing was to try it. With the cushions in place, it looked every bit a dragonfly, but as a passenger carrying device, we concluded

(Continued on page 111)



A wire braced framework of 1 by 2½ in. strips is covered with paraffined muslin to form wings for the toboggan



The original *Dragonfly* after many perilous trips down a Colorado mountain side

Replacing a Window-Pane

How to Remove a Sash from Its Frame, Take out the Broken Glass, and Putty a New Light in Place

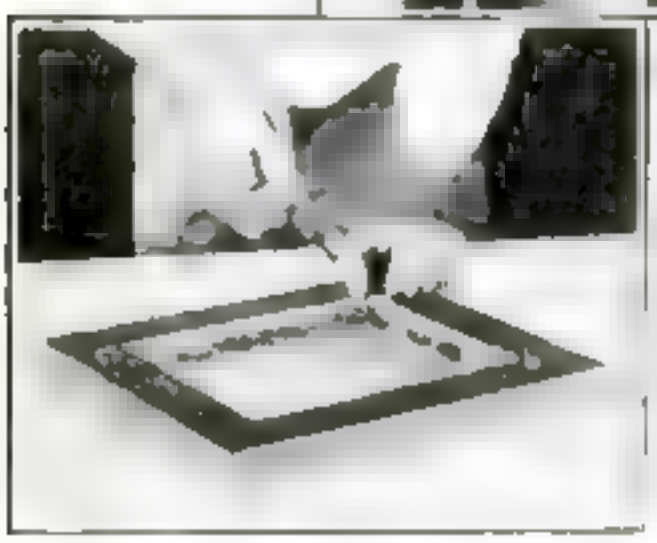
By F. E. Tustison, *Director of Science and Home Mechanics, The Stout Institute, Menomonie, Wis.*

1 Unless the window is easily accessible from the outside, the sash must be removed. First take off one of the inside stops

2 (Center) Raise lower sash slightly, pull it toward you, and remove sash cord. Tie a loop in the cord so that it will not slip into the weight pocket

3 To remove the upper sash, pull it all the way down, pry out the middle stop at the top with a chisel and remove stop by pulling out and up. The sash then is removed exactly as was the lower

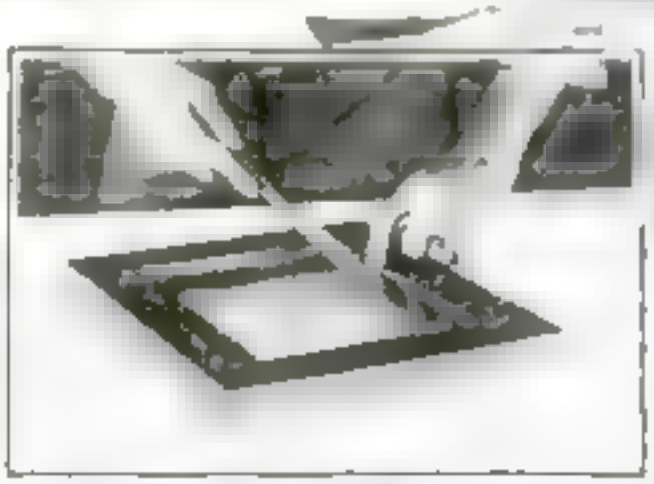
The accompanying photographs were posed by Otto P Schellinger, who is a specialist in household me-

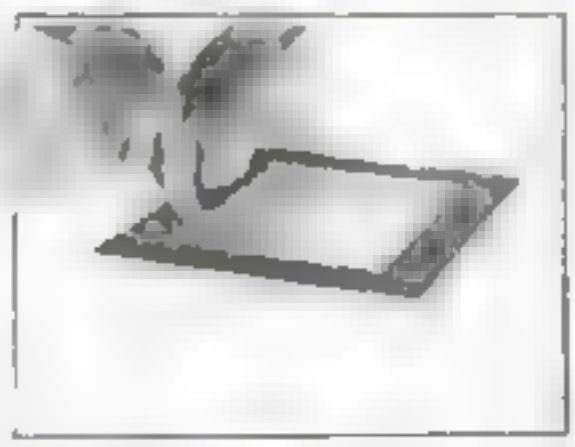


4 Remove the putty with an old chisel, which should, however, be reasonably sharp. Do not expose the bare wood or repainting will be necessary before the putty will stick

5 Either use the best linseed-oil putty you can buy or mix linseed oil and dry whiting together and add about one tenth as much powdered white lead, to give extra hardness

6 To make a really good job, "back-putty" the rabbet before inserting the new pane of glass, as shown in the central silhouette

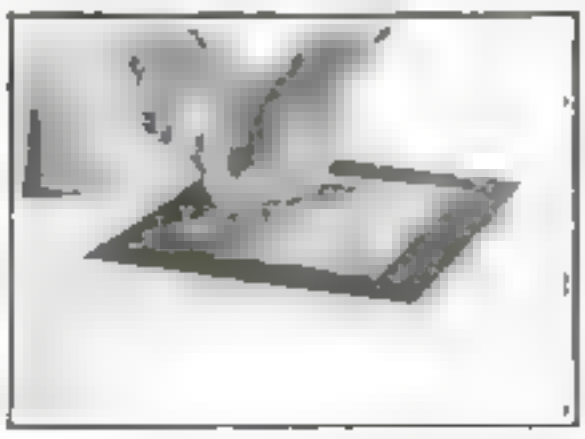




7 (At right) Press the pane firmly into the back putty and drive in a few glazier's points with your chisel

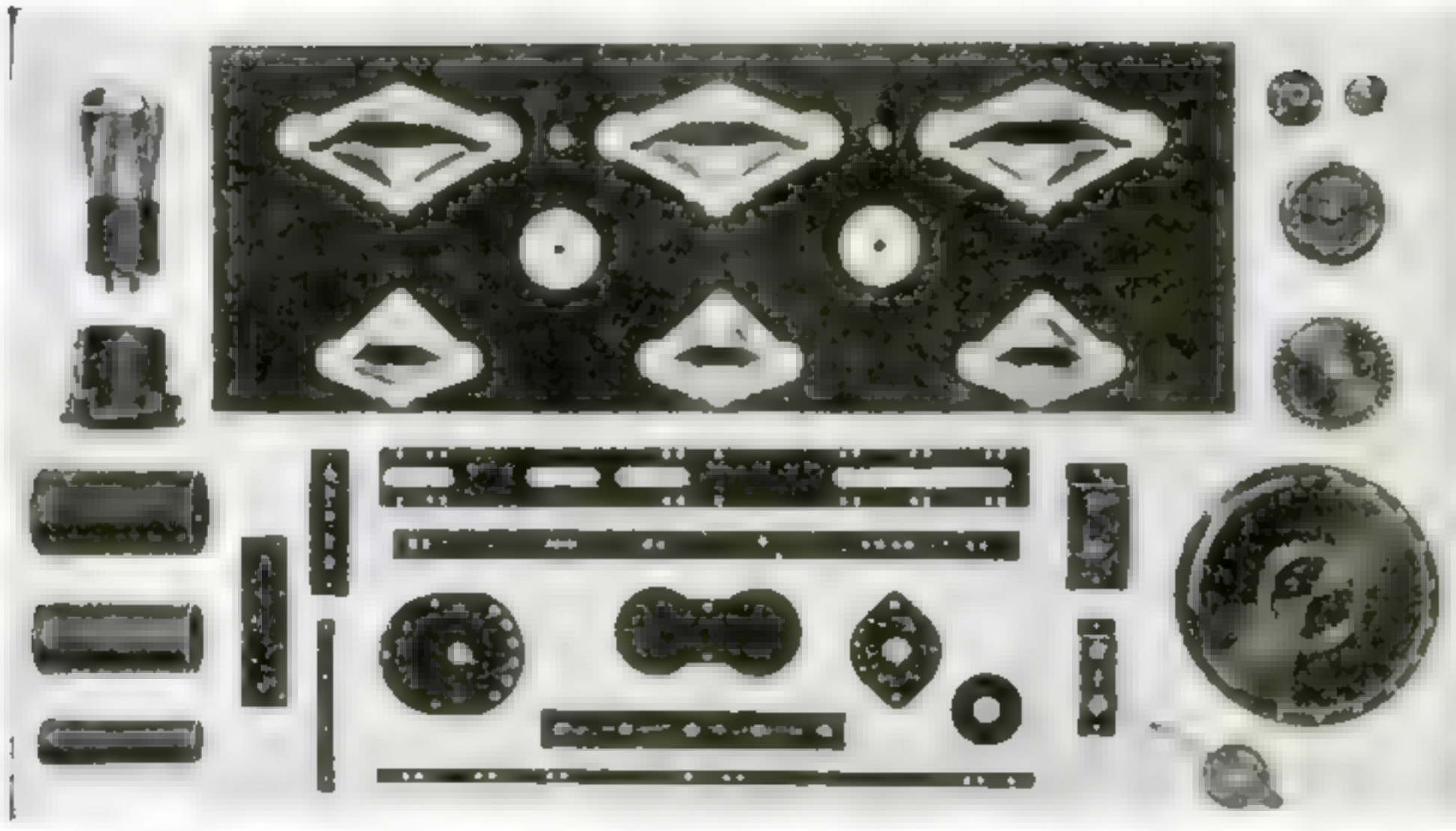
8 (At left) There are two ways of placing the putty. Perhaps the easiest for the amateur mechanic is to roll a thin string of putty and lay it bodily into the rabbet pressing it into place with a putty knife and smoothing it neatly with several continuous strokes from corner to corner

9 (At right) The experienced glazier does the job with almost incredible swiftness by feeding the putty under the knife as he draws it along the rabbet. This takes considerable practice unless one happens to fall into the trick naturally. Try it the next time you have to repair a broken light



10 If the sash is dark green, dark brown, or any other very dark color, the work of repainting the sash can be avoided (provided the original paint is in good condition) simply by blackening the putty as soon as it is applied with a little powdered lampblack

TURN TO PAGE 78 FOR THE CONTINUATION OF THE HOME WORKSHOP DEPARTMENT



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Better Shop Methods

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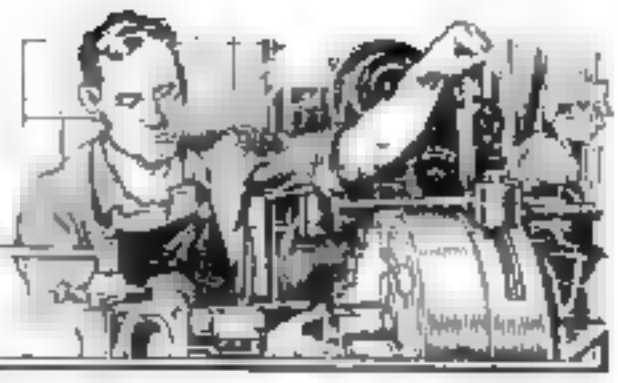


Old Bill *Threads a* Bent Pipe

By James Ellis

Machine-Shop Superintendent

JUDGING by the cars he recognized, as he stopped his flivver in the yard of the Robinson Mill, Old Bill thought he must have been summoned to attend a convention of all the mechanical men in town. He was a bit peeved, too, as there was much work to be done at the shop.

He followed a devious way through the mill to the superintendent's office, but high pitched voices coming from the engine room made him change his course. He came upon a group looking at the engine and studying some drawings.

"There is no use talking, Joe," the mill superintendent was saying to one of his assistants. "I don't care whose fault it is; what we must do now is to correct the trouble."

"I don't believe there is anything you can get done here that will help you," Jack Watson, Old Bill's chief competitor, said. "Nobody in town can cut a thread on a 12-inch pipe bent like that."

OLD BILL joined the group, and after the usual exchange of greetings the job was explained to him. The mill had put in new boilers and piping system, and everything was coupled together all right except one pipe, the last one. It was 12-in. pipe with flanges screwed on, and this particular piece had a bend with about a 10-ft. radius that went from the steam header to the throttle valve. It was too long, or the space it should go in was too short. The consulting engineer who had laid out the plant and the men who had put it in were still arguing that point.

"It looks to me as if the thing to do is to cut off a piece of the pipe," Old Bill remarked.

"The rest of us decided that a long time ago," Old Bill's competitor rejoined shortly.

The consulting engineer stopped his dispute long enough to say, "We do not think a weld should be permitted in this pipe."

"Can you do it?" was all the mill superintendent wanted to know.

"Yes," Old Bill said. "Get it down to the shop as soon as you can."

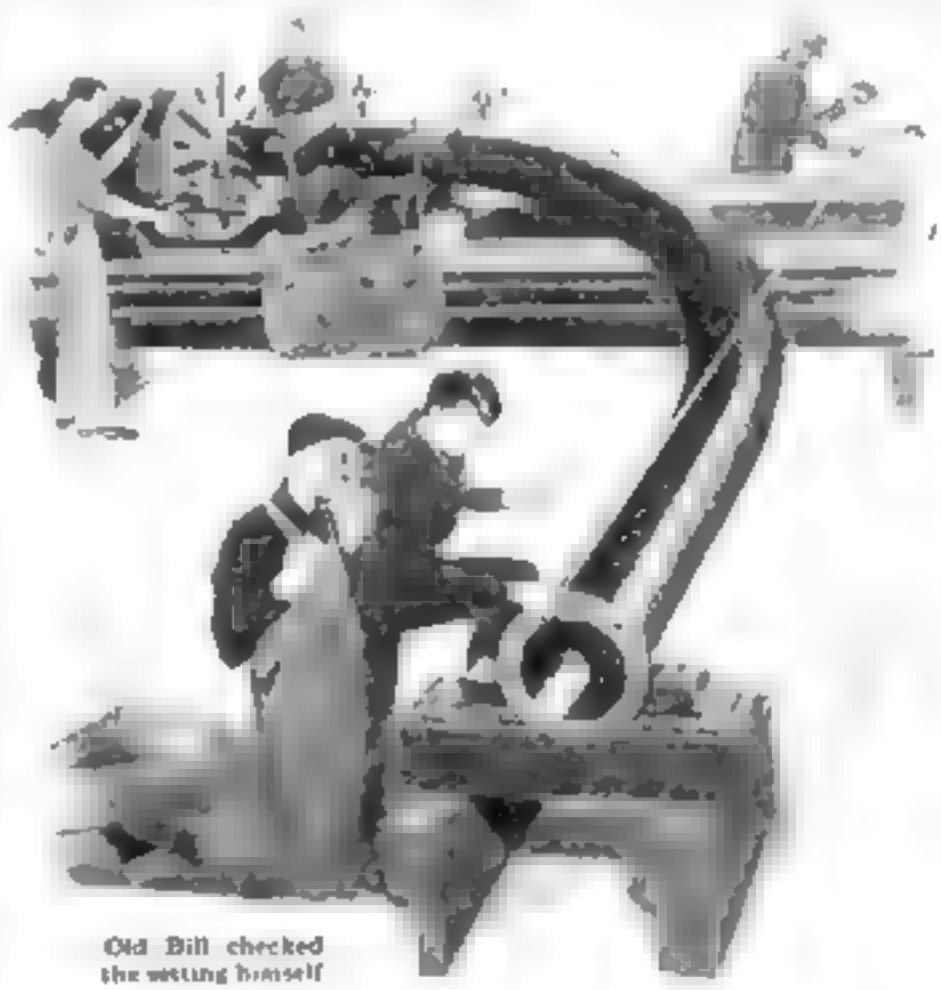
A wave of surprise seemed to pass through the group. "How are you going to do it?" Old Bill's competitor asked.

"Come down and I'll show you," was the answer, and, knowing Old Bill, every one laughed.

Old Bill realized that he had bitten off a mouthful, so as soon as he was back in the shop he set about to prepare for the pipe. He told Bob Laten what the job was, and gave him a drawing showing the dimensions that the pipe must be.

"But, boss," Laten protested, "we can't swing this in a lathe, and the pipe machine will not take it."

"That's all right," Old Bill replied. "We have a 36-inch lathe that will do the job. Here is what we will do. I will show you how I think we can handle it."



Old Bill checked the setting himself

Fortunately, the big lathe had room around it, and there was a small hoist overhead. Laten got a long straightedge, and, holding it on the faceplate of the lathe, he used a plumb bob to locate several points on the floor in line with the faceplate. Then he measured straight out from each of the lathe's centers and made other marks on the floor.

He had men bring in all the wood blocking they could find. Then he got a good sized angle-plate and bolted it on the faceplate. To this he bolted a full swing rest from a smaller lathe.

By this time the big pipe was being dragged into the shop. Laten had it raised and set on the lathe carriage. The other end he supported with some of the blocks.

It took a lot of straining to get the flange off the end that was to be threaded, but finally it was done. Then Laten blocked up that end so that it was about on a line with the lathe centers. He had his helper make some clamps to bolt the pipe to the lathe carriage, while he rigged up a roller support for the free end.

Truing up the pipe was rather tedious, but finally the work was located so that it was true and would roll on the blocks supporting the outer end for about 6 in.

A regular turning tool held in the toolpost attached to the faceplate was used for turning the pipe down to the correct size and taper for threading.

Old Bill came out and checked up the setting himself once more to be sure that nothing had slipped. "I think I will call up Jack Watson and get him to come over here and see how a real machine shop can do things!" he remarked good naturedly.

FOR cutting the thread the lathe was run backward rather slowly so that the tool could be fed in a little by hand at each revolution to get the proper taper. The tool was started cutting on the large diameter of the pipe and ran off the end while the lead screw fed the pipe away from the faceplate.

Old Bill figured out that the thread should decrease in size eight-thousandths with each thread, so he had Laten use the micrometer dial on the full swing rest to advance the tool this amount each time the faceplate made one revolution. For the final cuts a man was stationed on each side of the lathe, and the tool was fed in four-thousandths at each half revolution, so that a practically perfect thread was produced by this method.

When the flange had been tried on for the last time and had been found to fit perfectly, Watson shook his head, a trifle sadly, and said: "Next time I see something that I know can't be done, I think I will slip out of the way before you come around and do it!"

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 112 to 119.

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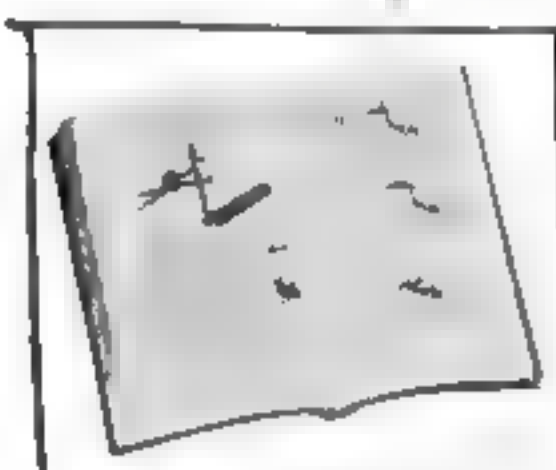

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The Home Workshop

How *to* File *a* Handsaw

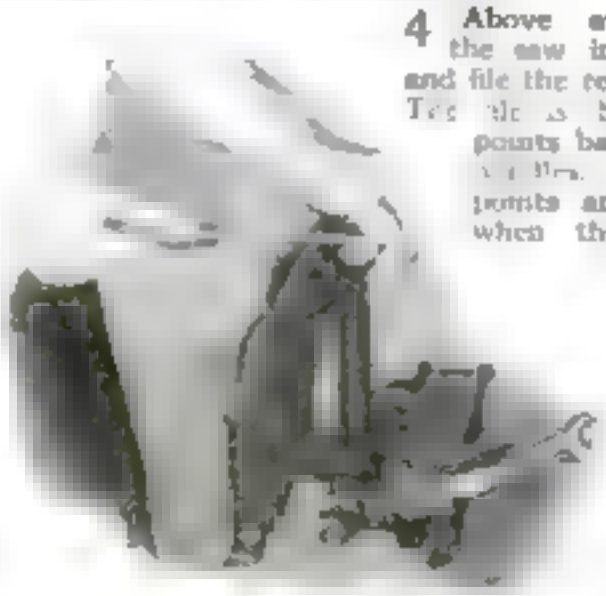
By Emanuel E. Ericson, *Noted Manual-Training Authority*

1 (At left) First true up the edge with a saw jointer or a flat file held on a block of wood. Take smooth, forward strokes. The edge should be a trifle convex or crowned

2 (At right) Using a properly adjusted saw set bend out every alternate tooth. Then reverse the saw and set the remaining teeth the opposite way

3 At right) A cross-cut saw may either be filed against the cutting edge of the teeth or with the teeth. This illustrates the first method. Run the file in front of every tooth that points out toward you

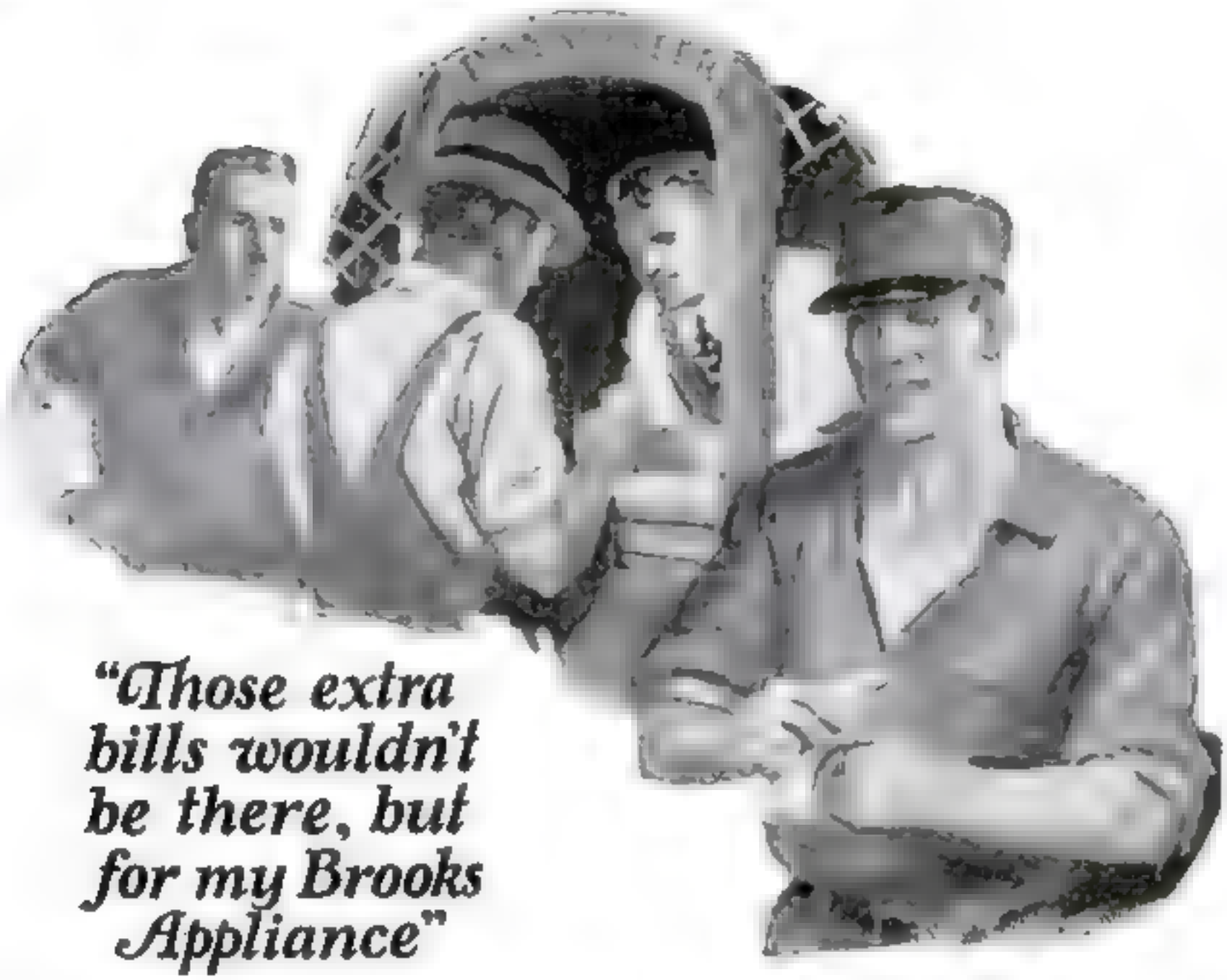
5 Below. When the teeth are sharp, lay the saw on a flat surface and take a stroke or two on each side with a fine oilstone



4 Above at left) Turn the saw in the saw vise and file the remaining teeth. The file is horizontal, but points back toward the handle. Watch the points and stop filing when they are sharp

6 To file a ripsaw, hold the file at right angles to the blade. Each tooth must be perpendicular on the front edge. Some mechanics prefer to lower the file handle a trifle. In either case it is well to file every alternate tooth from one side and then turn the saw. This compensates for errors

7 Straightening a kink with block and mallet. Beginners will find it a good plan to leave a few teeth at the extreme handle end of the blade untouched. It is these few teeth that will serve as a standard guide for setting and filing the saw



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The Home Workshop

Operating a Model Railroad by *Electrical Controls*

By James A. Baker

WHILE many men are interested in model railways, their particular fields of activity are not all along exactly the same lines. One man will spend most of his time on the production of locomotives. Another may be interested in the rolling stock of his model railway and a third, perhaps, may tackle the problems connected with control, signaling, and operation

In the article, "Automatic Control for Model Trains," published last month, instructions were given for making an electrically operated switch. A model track layout arranged so that all the switches are controlled by pushbuttons permits remarkably realistic operation of the model freight and passenger trains

Before taking up the ways in which electrically operated switches may be used, there is one detail in the construction of the switches themselves that deserves special attention

Standard track, as manufactured in this country, is made with the curved sections on a rather sharp radius. This is commercially necessary because the vast majority of sales of track are made in connection with small, popular priced, complete outfits consisting, usually, of a locomotive, two or three cars, and a circle of track with just a few straight pieces Most of the owners of these small outfits have but limited space for a track layout—too small, in fact, for curves of large radius.

Switches, naturally, are made to the same radius as the regular curved track This is all right if you stick to commercial freight and passenger cars, but when you start building scale models, trouble is experienced in getting the longer cars through the switches

You will see in Fig. 1, the easiest way to remedy this trouble. A standard switch is shown alongside one that has been altered by cutting away part of the curved section so that the cars go onto the siding, or wherever the switch leads, without so much curved track. This arrangement is particularly valuable when the curved portions of two switches are connected as, for instance, in a cross-over. I have found that switches altered in this manner

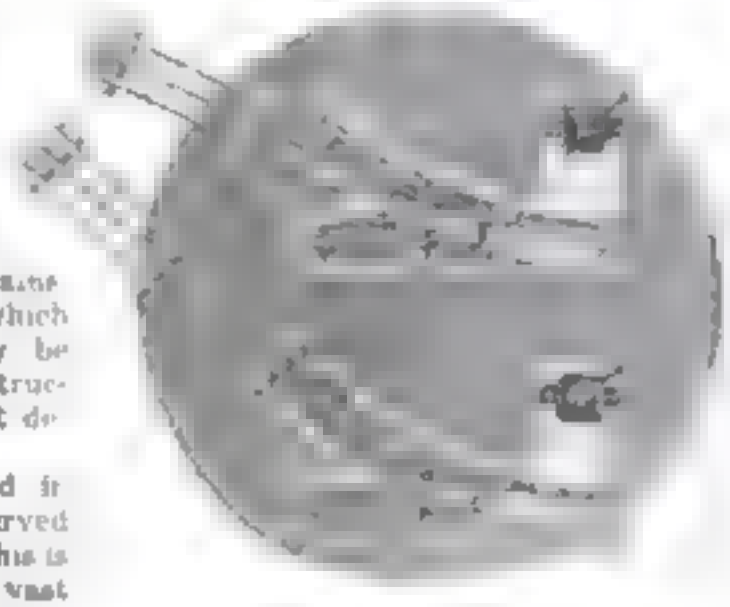

Fig. 1 A relatively straight switch for high speed train operation, and a standard switch

improve the operation of the standard rolling stock to a marked extent.

Now study Fig 2 You will see that it shows a track layout consisting of two complete rectangles with a double cross-over on each side. Such an arrangement calls for eight switches, and if these all

(Continued on page 108)

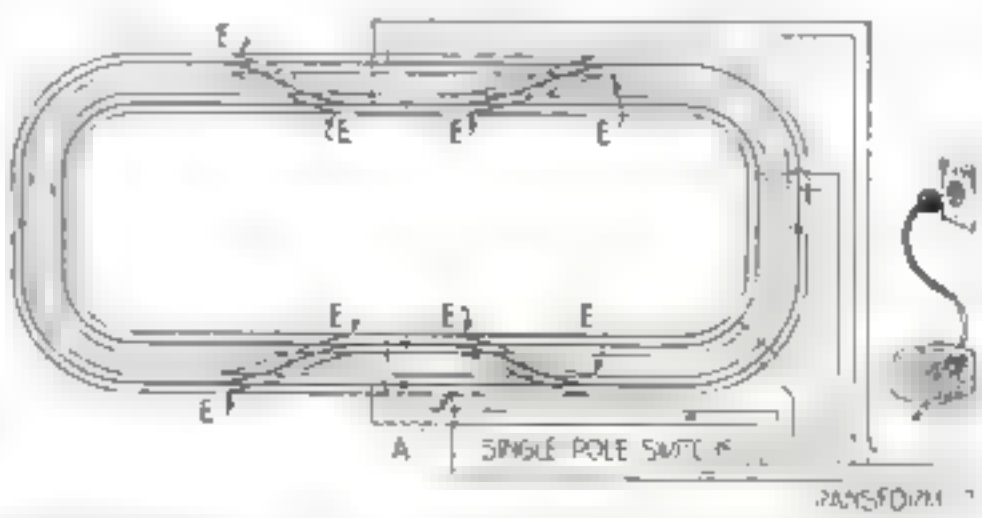

Fig. 2 Diagram showing track layout and wiring for current control Center pins are removed from hard rail at points marked X One wire from transformer goes to track at any convenient point on outside rails A The other wire from transformer goes to switches each of which is connected independently with a different section of the third rail

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WHEN your radio set goes wrong, just as you are comfortably settled before the fireplace expecting to spend a great evening, it *is* annoying.

And ten to one, it's only some little wire or part that in itself is insignificant. Really, though, there's no excuse for such things happening.

GOOD parts of good material and carefully built are insurance against such annoyances.

Cutler-Hammer radio parts are GOOD parts. Both the amateur builder and the set manufacturer can attest that fact. They are designed by radio control experts, backed by 25 years experience, built of the highest quality material and sold at a price you are glad to pay.

Whether you buy or build, insist on C-H radio parts, for it's these good little parts that count and assure constant, efficient service from your set.

The closely wound, fine resistance wire is prevented from slipping or wearing out of true by a bronze spring. That smooth, quiet control is assured either advancing or decreasing the potential.

There is no jumping, no back lash and no sticking.

While C-H Rheostats are built to engineers' specifications, they are designed for the use of the novice. They are built as a unit and are not dismantled for mounting.

Only one hole for mounting. Self centering on even-size holes and adjustable to any panel thickness.

THE CUTLER-HAMMER MFG. COMPANY

Member Radio Section, Associated Manufacturers of Electrical Supplies

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Radio Parts for Performance

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Home Workshop

Sharpening *Your* Skates

Five Ways to Give the Runners a Keen Edge

By Lawrence B. Robbins

ALL the real fun of skating is lost if your skates are dull. Worn runners mean side slipping, uncertain footing, and consequent loss of speed in racing or during ice games. It behooves the true skating enthusiast, therefore, to keep his skates well sharpened.

The sharpening can be done at home with the aid of the few ordinary tools shown in the accompanying photographs.

Skates can be filed singly at the bench, as demonstrated in Fig. 1, by clamping the heel in a vise and drawing a good sharp file at right angles down the blade. Care must be used, to keep the file flat on the blade. An easier method of filing a pair of skates is shown in Fig. 2. Two blocks of soft wood, over which the heel clamps of the skates can be fastened, are nailed to the workbench. They should hold the skate blades parallel and as close together as possible. A third piece of wood should be placed in front of these to take the front ends of the skates. When the skates are clamped securely in position, sharpen them with a clean, flat file. Draw the file over the two runners at a slight angle and work from back to front of the runners until the edges are keen.

Fig. 1 (above)—Sharpening a skate with a flat file held at right angles to the blade

Fig. 3 (below)—A true edge is insured by holding the bit in a slotted wood block

Fig. 2 (at left)—A safer method for beginners is to fasten a pair of skates down and file both at once

Fig. 4 (above)—It is even possible to file the runners hollow by using a round file clamped firmly in a hardwood holder

Fig. 5—Simple wooden fixture (right) for holding a skate to be hollow ground as at left

A device for sharpening one skate at a time is shown in Fig. 8. It consists of a block of hard wood about 1½ in. square and 4 in. long. If no block is handy, screw two ¾-in. pieces together. Cut an oblong hole through the side of the block to allow a flat file to be inserted, and below it cut a longitudinal slot to fit over the skate runner. A screw in the top of the block is used to hold the file rigidly in position. Draw the skate through the slot, against the file, or fasten the skate to the bench or in a vise and draw the file over the runner, as shown.

(Continued on page 165)

If This isn't the National Blend,—What is?

By Irvin S. Cobb

IT'S ripening time down South. On gentle hillsides where soil conditions and climatic conditions are in proper tune with each other, the tobacco—the perfect native cigarette tobacco—is ready for harvesting. Under the blazing sun the matured plants have been taking on shape and tint. The blades have been broadening, growing rich with the strength of the earth. So now workers harvest the crop from the fields, and bear it to the barns for curing.

It is cured slowly by a heat that is regulated to match the weather. The result is such tobacco as no other part of the world yields—strong in perfume, gentle in flavor, alluring in color, and in texture like taffeta silk.

* * * * *

It's thawing time up North. The drifts in the valleys of the Green Mountains are shrinking. On warm melty days there's a taste of spring in the air. The first blue-bird is back to meet the chickadees

that have been away and the melody in his red breast makes him forget the frost-bite in his toes. They have tapped the maple trees. The clear sap drips into the pails. In the boiling pots this sweet juice, which is the very essence of the New England groves, is being turned into firm, brown cakes. It hasn't been dosed with chemicals, nor doctored with flavoring matter or coloring matter. It hasn't been cheapened with admixtures of any coarser sweetening. It's the honest maple syrup, unadulterated and perfect.

* * * * *

This year's maple sugar, with nothing added to it and nothing taken away, is brought to where the pick of the tobacco of three years ago or four or five even, has all this time been ageing naturally. It's vintage tobacco by now.

By a process which has had the endorsement of smokers all over the world for forty-seven years the prepared leaf is treated delicately with the pure sugar. That practically is all—just a mellowed, harmonious, aromatic, crusty mingling of the two F. F. V's—the Finest Flavor of Vermont, the Finished Fragrance of Virginia.

And you have the Sweet Caporal Cigarette. If Sweet Caporal isn't the true North-and-South blend, the real National Brand, what is?

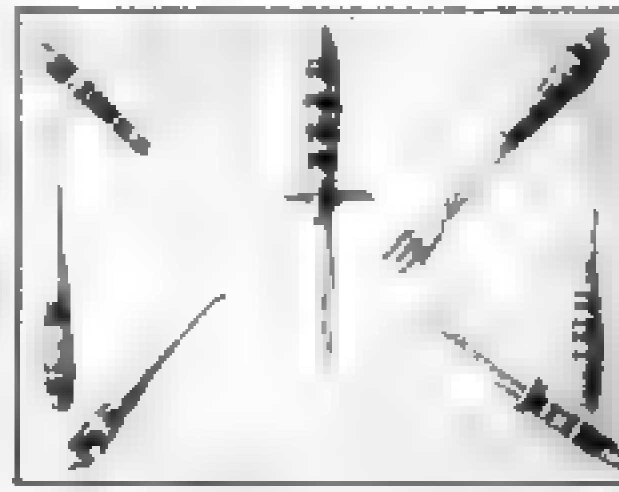
Thank you. Irvin S. Cobb

P S. *I write an article like this every once in a while. Watch for the next. I have declined propositions to turn out advertisements for various manufactured products because I feel I merely would be a hired hand, exploiting this, that or the other thing for so much a word. But I reached for this opportunity. I knew I could put my heart in it—could with sincerity endorse the article I was praising.*

The Home Workshop

Ornamental Cutlery Handles Made from Odds and Ends

IN THE winter, when my farm duties give me sufficient leisure, I make ornamental cutlery of the type illustrated below. Some are made from cold-rolled steel and others from tool steel, heated, hammered out, and dressed with a fine



From 65 to 100 washers of contrasting materials form the handles of these unique pieces

file and emery powder. The entire length of the handle end is threaded.

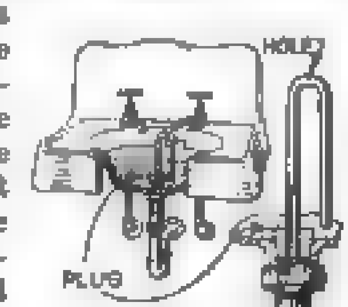
The handles are made from thin pieces of various woods, brass, copper, aluminum, and celluloid of different colors. The first piece is metal and fairly heavy. It is tapped and screwed on. The other pieces, except the one at the very end, are put on like washers. The end piece serves as a nut to draw the parts together.

The handles then are dressed and polished. The number of pieces used range from 65 to 100, depending upon the thickness.—HORACE A. MARWOOD.

Washing Photographic Prints

WITH the addition of the special stopper illustrated, the bathroom lavatory becomes a satisfactory print-washer. The water containing the hypo is drawn off from the bottom.

A wooden plug is made to fit tightly in the drainage hole. A siphon, made from a piece of copper or brass tubing 1/4 in. in inside diameter, is inserted into the plug. This connection must be water-tight. The siphon is bent so it is not quite the height of the overflow outlet, and the shorter arm is about 1/2 in. from the bottom of the basin. A small hole about 1/16 in. is drilled through the siphon at its highest point.



The special stopper

When the water is turned on slightly, the basin fills to the level of the hole in the siphon. At that point the action begins. Should the inlet flow exceed the outlet flow, the water merely passes out through the overflow, but if the water is turned off, the action stops.

A similar but larger device may be employed in a stationary laundry tub for washing quickly and thoroughly blueprints and other large prints.

Blueprint Shows How to Build Salem Chest

DECORATIVE and beautiful as this chest of drawers is, the construction is of the utmost simplicity. There is not a single difficult joint—not even a rabbet or a groove, the case is put together like a box, with butt joints and nails, so that a beginner can build it. In that respect it is unique, for in no other piece of furniture of equal style and appearance, so far as it is known, has such an ingeniously simple method of joinery been used. The details are contained in Blueprint No. 39 listed below

Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.
Popular Science Monthly
250 Fourth Avenue, New York

GENTLEMEN

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents.

No.	Title	Published	Price
1	Sewing Table	Feb. '33	25c
2	Smoking Cabinet	Mar. '32	25c
3.	End Table	Apr 32	25c
5.	Kitchen Cabinet	May 32	25c
8.	Shaving Cabinet	June 32	25c
9	Arbor Gate and Seats	July 32	25c
10.	Porch Swing	Aug '32	25c
11	Bench and Tilt Table	Sept 32	25c
12.	Electric Washer	Oct 32	25c
13.	Tea Wagon	Nov 32	25c
14	Christmas Toys	Dec 32	25c
15.	Workshop Bench	Jan 33	25c
16.	Inlaid Radio Cabinet	Feb 33	25c
17	Cedar Chest	Mar 33	25c
18.	Floor Table and Stool	Mar 33	25c
19	Grandfather's Clock	Apr 33	25c
20.	Flat Top Desk	Apr 33	25c
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22	Cabinet and Desk	Apr 33	25c
23.	Pergola Garage	May 33	25c
24	Gateleg Table	June 33	25c
25.	Casting Sailing Outfit	July 33	25c
26.	Baby's Crib and Pen	Sept 33	25c
27	Kitchen Cabinet Table	Oct 33	25c
28.	Pullman Play Table	Nov. 33	25c
29	Toy Tea Cart etc	Dec 33	25c
30.	Tool Cabinet etc	Jan. 34	25c
31	Sewing Cabinets	Feb. 34	25c
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34	Garden Trellises	May 34	25c
35	Simple Radio Cabinet	Oct 34	25c
36.	Rush Bottom Chair	Nov 34	25c
37	Simplified Bookcase	Dec 34	25c
38.	Sheraton Table	Jan 35	25c
39	Salem Chest	Feb. 35	25c
40	Desk in Sheraton Style	Mar 35	25c
41	One Tube Radio Set	May 35	25c
42	Three-Stage Amplifier	June '35	25c
43.	Four-Tube Receiver	July 35	25c

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Please print
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The Home Workshop

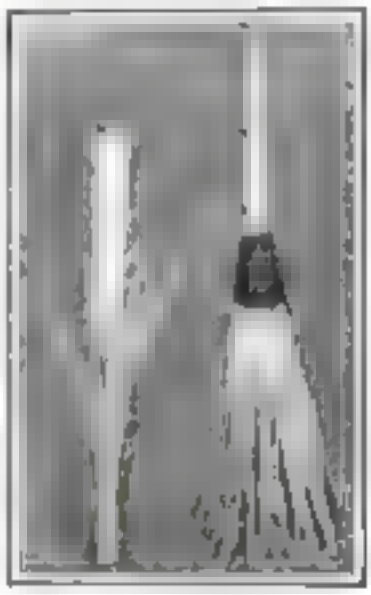
Could You Whittle a Broom with Your Pocket-Knife?

By Herbert L. Childs

FOR one who has a keen pocket-knife and knows how to use it, it is no trick at all to whittle a whisk-broom. It is a good project for the whittler to try occasionally, when he has an odd half-hour to spare, as a test of his ability to make clean, thin, slicing cuts, and it makes a neat demonstration by which the home worker can display his virtuosity with a penknife.

There are so many kinds of wood one may choose that it is difficult to say what kind is best. That used for making the broom illustrated was white birch.

Have the stock free of knots, about 16 in. in length and perhaps 1¼ in. in diameter. Allow plenty of room at one end so that you can hold the stock firmly.



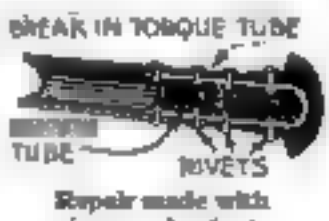
Two stages in making wooden whisk broom

Start about 6 in. from one end, cutting with the grain. Cut a strip about 3 in. in length, stopping about 2 in. from the other end. Cut as many more as you can, going completely around the stick. These you must bend backward and hold against the bottom end of the stick. Then repeat the operation until you have cut enough to make a broom of the size you wish. The slivers then should be bound tightly against the 2-in. end of the stick. Cut off the handle to suit the fancy and trim the brush end evenly.

THIS is the third article by Mr. Childs, one of the foremost authorities on whittling. The first appeared on page 89 of the September, 1925, issue and the second on page 82 of the October, 1925, issue.

Splicing a Broken Torque Tube

WHILE working on a portable sawmill, the torque tube of my Ford truck broke. As no replacement was to be had, I made a temporary job by cutting a piece of 2½-in. pipe about 10 in. long and placing it in the end of the broken tube. Holes were drilled through both tube and pipe. A shaft was placed inside the pipe, and pipe and tube were riveted together with rivets made from large spikes. The remaining piece of torque tube was forced over the protruding end of the pipe and riveted solidly in the same way.



Repair made with pipe and rivets

—OSCAR M. ANDERSON.

The Home Workshop

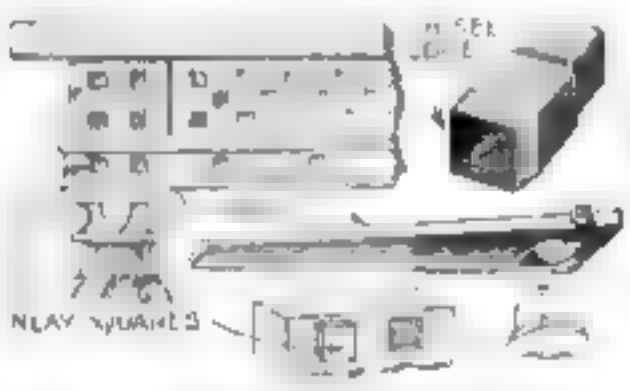
Quick Method *of* Making Inlays

By Roy L. Gerding

INLAYING homemade furniture generally is considered by the amateur woodworker to be a tedious and somewhat difficult job. I have been experimenting with various methods and have developed an effective way to make inlays that does not take much time.

You will need four or five chisels of special design. These are made from square and hexagonal socket wrenches of different sizes. For ⅛ in. back the lower edges should be ground or filed to about the thickness of a hacksaw blade. The edges then should be ground like chisels and honed as keen as possible on an oilstone. A handle of some sort should be made for these hollow chisels, a simple type being illustrated.

The inlays are cut from pieces of wood planed to ⅛ in. or less or from scraps of thick veneer, if available. The cutting should be done on a heavy block of wood



Hollow chisel made of socket wrench, the chisel handle, and the simplest type of inlay

sawed squarely and placed end up. A punch is needed to knock the inlays out.

The recesses for the inlays are outlined with the same chisels and the waste wood is removed either with an ordinary chisel, a bent woodcarver's chisel, or a chisel made from a broken hacksaw machine blade or an old file.

When the inlays have been fastened in place with the best grade of liquid glue, they can be planed and scraped flush with the surface or allowed to project a trifle to give a relief effect, as in the overlays that are now so popular.

This method of inlaying is adapted especially to designs of odd or Oriental variety. A surprising number of patterns may be made by combining the pieces cut by different tools. It is well to draw a few combinations before deciding on the one to use for ornamenting any particular piece of furniture.

An Oriental table may be made by enameling the wood jet black and ornamenting it with inlays colored pearl gray, enlivened in places with touches of blue. The blocks are painted with artist's oil colors, which come in small tubes. The painting should be done before the blocks are inlaid and the colors later given a protective coat of clear varnish.

This method of inlaying can be used to advantage on radio cabinets, footstools, chairs, and many similar articles.

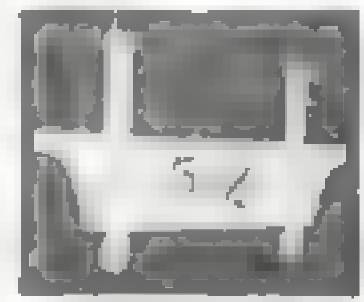
![The Home Workshop]

The Home Workshop

Neat House Number Sign Is Visible at Night

YOU are groping your way along a dark street, trying to locate the home of a friend who recently moved. You have no idea how the numbers run, but suddenly you see a lighted window against which appears a neat sign. This is cut out so that the light shines through in the form of figures—the very number for which you are looking.

Seeing the advantage of such a house number, you may wish to make one for your own home. Packing box lumber will do very well. A good size for the main piece is ¾ by 5 by 20½ in. Lay this on a piece of wrapping paper and mark around it. Cut the paper on the line and fold the piece in two, so that you can lay out an ornamental curve for the ends. By cutting with the scissors, both ends will be symmetrical. Also lay out the figures on the paper, choosing a style that can be cut out easily, such as one having the circular terminals, which can be made by boring. Cut out the ends and figures with a coping or scroll saw.



The number sign is hung before a window

A piece ¾ by 1½ by 24 in. is cut in half to form the two supports. These are recessed ⅜ in. deep where the number piece crosses them so that the sign can be nailed together with the outer surfaces of all parts flush.

Give the whole a coat of light paint and hang by means of screweyes and chain in front of a window, side light, or glazed front door. Many original and attractive variations from the design illustrated are possible.—W. W. WHITE.

Realistic Toy Fire Truck Made from Scraps

WHEELS from an old carpet sweeper, steering gears from a discarded sewing machine, and scraps were utilized in making the toy fire truck illustrated. It is 26 in. long, 8 in. wide, and 8 in. high. It weighs 20 lbs. and will support a weight up to 300 lbs. The metal-working tools used were a post drill, files, and a hacksaw.—WARREN D. PARIS.

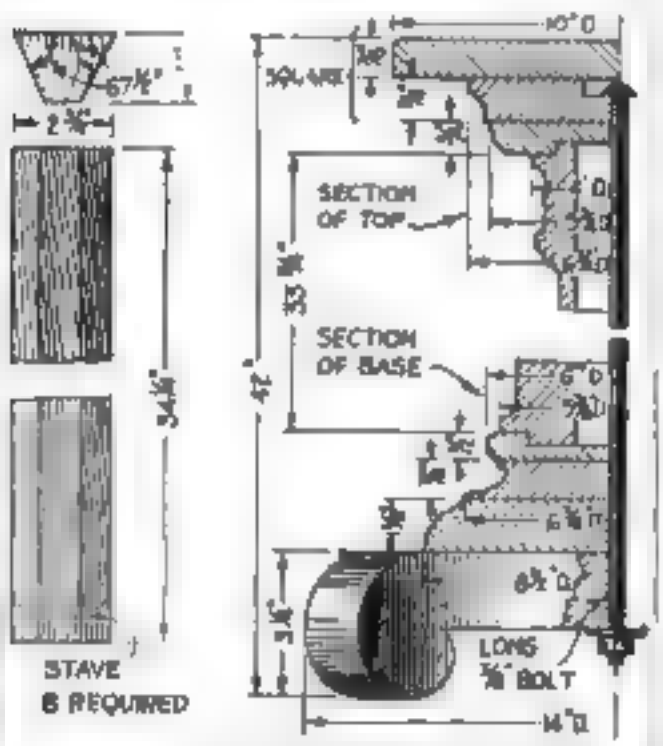
Graceful Turned Stand for a Jardinière

By William J. Edmonds, Jr.

An ornamental plant stand the round pedestal of which is built up of eight staves

CONTRARY to the first impression conveyed by the accompanying photograph, the construction of this plant stand is not beyond the ability of the average amateur woodworker who has access to a lathe.

The column is built up of eight segments, as shown in the drawing. These are made slightly longer than the dimensions given and are glued up edge to edge to form an octagon. After the glue has hardened, this column is made circular



One of the staves and a section showing the construction and profile of the pedestal

in shape with drawknife and plane. Two octagonal plugs are fitted into each end so that the pedestal may be placed in a lathe and turned to the shape indicated

(Continued on page 94)

The Home Workshop

Kitchen Ceiling Vent Carries Off Fumes of Cooking

A VENT above the gas range for drawing off steam, smoke, and cooking odors has come to be a real necessity in the modern home. An improved "smoke catcher" for a bungalow or any house where the space above the stove corner of the kitchen is not otherwise utilized, may be constructed as shown below.

The ceiling joists above the kitchen chimney flue are cut away to make a square opening about 4 by 4 ft. The loose ends are braced with a header. A vent box 8 by 8 in. is placed 8 in. higher than the top of the ceiling joists. Con-

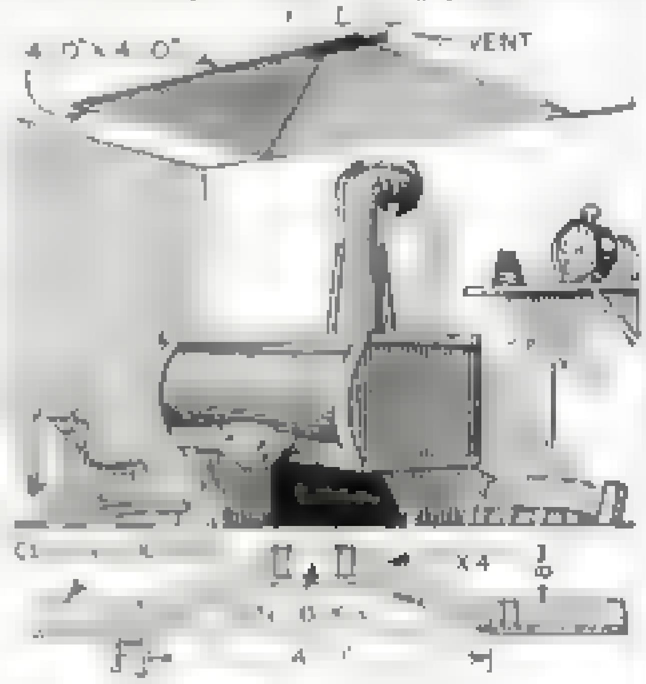


Diagram showing the general arrangement of the ceiling vent and a cross section

necting braces of "two by fours" are run from each corner of the vent box to the plate. These support the vent and carry the lathing. Additional braces may be used if desired. The recessed portion then is lathed and plastered or finished with wallboard like the ceiling.

Nail screen wire over the vent box from above and connect it, at any desired angle, with a galvanized iron roof vent by means of another box of rough lumber 8 by 8 in.

As the ceiling vent is placed at the highest point above the stove, the greasy smoke and fumes pass upward through the screen and then through the box to the roof — A. MAY HOLADAY.

Graceful Turned Plant Stand

(Continued from page 89)

Note that there is a tenon on each end.

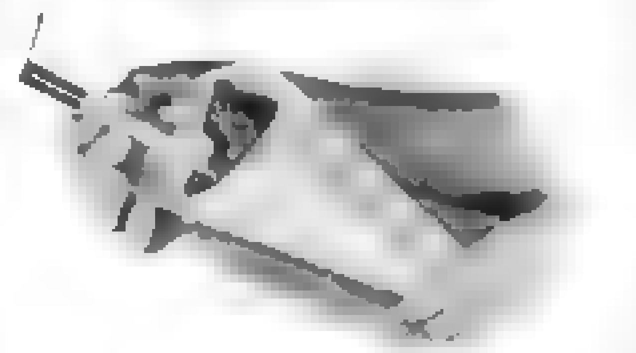
Instead of turning the column with straight sides, it has a slight swell from the base to about two-fifths the height, where it begins to curve in toward the top. This gentle curve is to overcome the optical illusion of slight concavity that a straight-line profile would have.

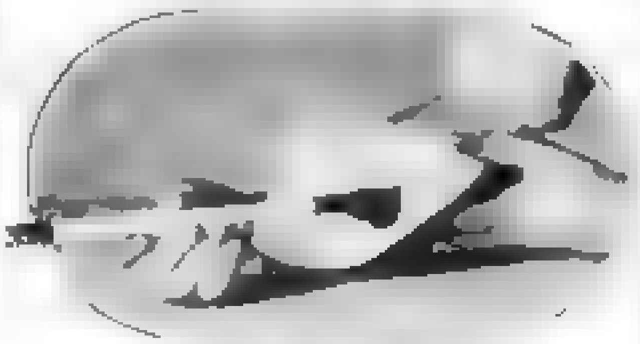
The remainder of the construction requires no explanation, excepting that a long ⅜-in. bolt or a rod threaded at both ends passes through the center of the different pieces and when tightened keeps all in place.

The pedestal may be finished as the taste of the builder dictates, preferably with varnish or wax.

New Handkerchief Vanishing Trick

By Kenneth B. Murray





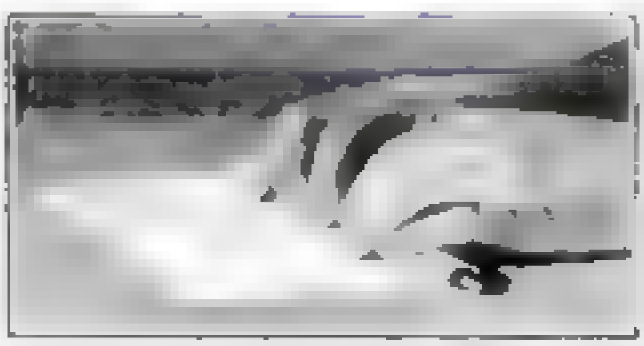
How the handkerchief is stamped into the cone and the "vanish" as the performer sees it

OF THE many methods for vanishing a handkerchief, the one pictured above is perhaps the easiest for the amateur to master and, at the same time, it is one of the most spectacular.

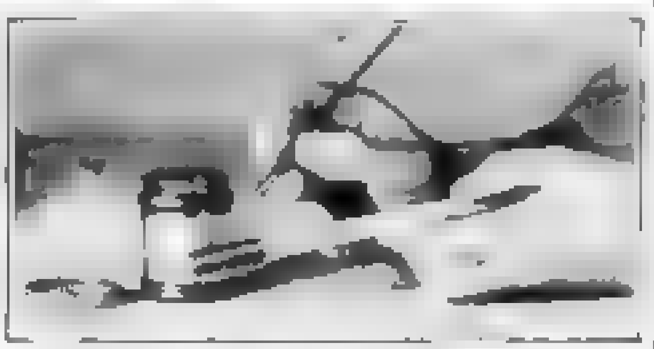
A small silk handkerchief, preferably bright red, is placed in an unprepared paper cone. The magician stamps the handkerchief into the cone with his magic wand and, as he withdraws the wand, shows that the handkerchief has disappeared.

The secret lies in the construction of the wand, which is hollow. In the wand is a

(Continued on page 92)



The paper wand is rolled about a pencil



Coloring the tube with waterproof paint

The hook and thread drawn out from the wand

Riding an Ice Chair Is Novel Sport for Skating Parties

WHEN the ice is thick enough for skating, you can have a lot of sport by equipping a common folding camp stool with runners to form a skater's chair. The runners, which are strap iron or even wood, are bolted to the legs of the chair.

The occupant of the chair sits with his or her skates directly in front and must grip the chair firmly so as to present a stiff back to the one who is pushing from behind. When not in use on the pond, the chair can be used near the edge by those who wish to rest or remove their skates.—G. EVERETT VAN HORN.

Handkerchief Vanishing Trick

(Continued from page 91)

small hook tied to a ¼-in. length of pencil. To this hook is fastened a strong black silk thread, which runs through the wand and is tied to a black button on the magician's vest.

The hook lies near the end of the wand that is used to stamp the handkerchief in the cone. During the stamping process the handkerchief is caught by the hook and then it is drawn into the wand by a movement that carries the wand away from the body. This movement, while appearing perfectly natural to the audience, causes the thread to pull the hook from one to the other end of the wand and draws the handkerchief out of sight. The black thread cannot be seen at a distance by the audience. The clothes of the performer, of course, should be dark in color.

After the "vanish," place the wand with its contents in the inside coat pocket, at the same time attracting the attention of the spectators to the paper cone, which they should be asked to examine. If they wish to see the wand, hold the handkerchief and hook by the thread and draw out the empty wand.

The wand is prepared by rolling a sheet of heavy typewriter paper around a pencil, gluing the edge, and coloring the tips with waterproof black paint. The short piece of pencil with the handkerchief hook should fit tightly.

The Home Workshop

Discarded Cream Separator Converted into Forge

IN THE junk pile there is often some discarded machine that can be converted into a forge. In this case an old cream separator was used.

A fan was made and mounted in place of the bowl, with a bicycle hub for ball bearings. The axle was connected with the high speed shaft and, as there is a friction clutch in the machine, the handle can be worked as a lever without turning it all the way around.

On the crank handle shaft is mounted a rope drum. The rope, which is carried from the drum over a sheave mounted high up, is tied to a large pail filled with concrete. The crank can be turned backward to wind the weight up and the weight then keeps the forge running for a time while ironwork is being hammered out.

Winding up a counterweight keeps the blower running for some time

The speed of the fan can be regulated by the weight. The upper air intake on the fan case helps carry away the smoke.

The tuyere iron for the fire pan is made from a 2-in. well pipe driving cap, crown side up, with a bolt set in it as a shaking handle. Four ¼-in. holes were drilled in it to admit the air.—A. C. Brundage.

Canvas-Covered Frames Form a Decorative Screen

AFTER refinishing a breakfast room suite, I hunted unsuccessfully through the stores to find a folding screen that would harmonize with the furniture and at length built a screen of my own design.

The screen is painted to match other pieces

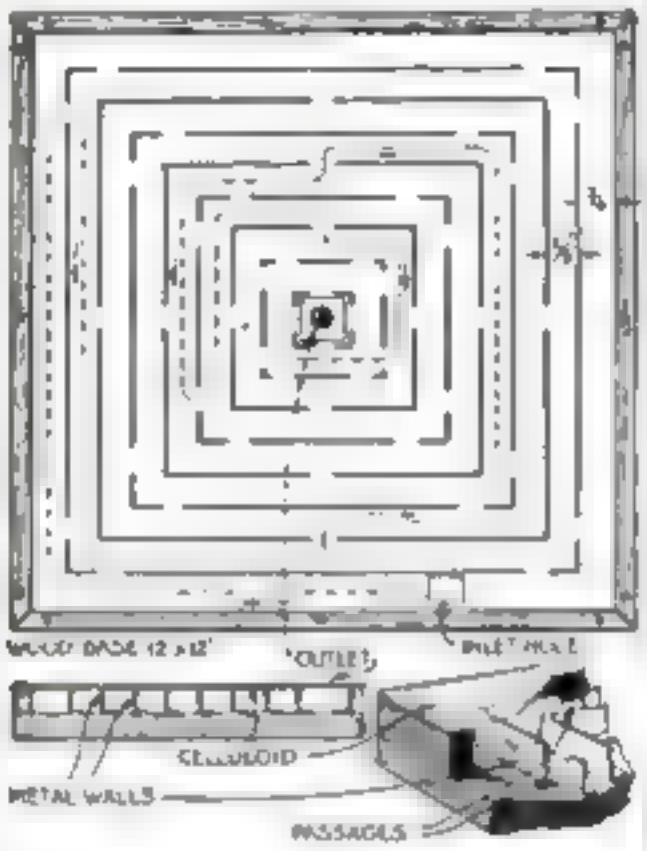
The frames are made of 1 by 2 in. finished white pine, butt jointed, with steel angle clips inside each corner. These are covered with light canvas—muslin will do—sewn like a bag on a sewing ma-

(Continued on page 94)

The Home Workshop

Complicated Labyrinth Puzzle Can Be Constructed Easily

LABYRINTH puzzles exert a perpetual fascination, especially when they depart from the conventional and familiar designs. In the puzzle illustrated, a marble is inserted through a hole in the celluloid cover and rolled around the corridors until it reaches the center, when it can be removed. The problem is apparently an easy one to solve as there



Only one opening in each division is large enough to allow the marble to pass

are numerous openings, but the marble will pass through only certain ones.

The base is wood, ½ by 12 by 12 in. It is bordered with strips ½ by ¾ in., to which the celluloid is to be fastened. The divisions are made of thin metal as shown, and are tacked in place. While each has four or more openings, only one gap is wide enough to allow the marble to pass. The others are a trifle too narrow, the difference of a hair's breadth being sufficient. It should be so slight that it cannot be noticed by the player.

When the openings have been tested, the cover is cemented and screwed or tacked in place.—DONALD W. CLARK.

A Decorative Screen

chine. Each of the covers must be of a size to slip over the frame tightly. The open end then is lapped under neatly and tacked in place.

The canvas is coated with size composed of 1 lb. of glue and 8 qts. of water. As many coats are applied as are necessary to pull the fabric taut.

The entire surface of the panels then is given two coats of light gray waterproof enamel. The edges are bound with ½-in. gimp fastened with upholstery nails. Designs are stenciled on one side with oil-tube colors to match the other furniture.

The panels are fastened together with double-jointed brass screen hinges, which allow the screen to be folded in either direction.—J. P. HARDECKER.

Ⓑ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Home Workshop

Gumption with Tools

(Continued from page 71)

auger, and a saw, and he could make a river raft, a corduroy road, post-and-rail fence, a barn, a hen coop, a pig sty, a dog house, a church, a fort, or a village, and these structures would be more substantial than similar structures of today.

But, to these three tools the men of yesterday added that great quality that is produced by the frontier and has enabled us to bore through mountains, to bridge over chasms, to go under and over rivers, to build the Panama Canal, to manufacture and operate steam engines, automobiles, flying machines, steam craft, sailing craft. Without it every invention of today and all the tools in the world are so much rubbish. That quality, that attribute of the mind, is GUMPTION.

IT'S gumption that made the Yankee notions famous; it's gumption that is absolutely necessary for a plainsman, a mountain man, a pioneer, a backwoodsman. He must possess it or die.

It is the absence of gumption that makes what we call a "chump" or a "boob," a "duffer," a "doodle," a "dizzard," a "noddy," "dunderaddle," or a "mollycoddle," according to the part of the country in which we live.

The Huck Finns, the Tom Sawyers of the river bottoms, the street gamins of the city, all have gumption. The old-time workmen possessed a phenomenal amount of gumption, but it seems to be sadly lacking today.

While sitting around the blazing logs of a camp fire in the mountains one winter night in company with Frederick K. Vreeland, electrical and consulting engineer, Col. David Abercrombie, the famous outfitter, Edmund Seymour, the banker and former ranchman, and other boon companions, some one noticed a lump, wart, or bunion, so to speak, on a white oak cordwood stick, which was about to be put in the fire. Such protuberances are known as "burls."

THIS burl was removed from the stick of wood by means of the camp axe. After that it was passed from hand to hand and modeled until it took the form of a drinking cup, or "noggin."

Dry oak wood is exceedingly hard and difficult to cut. These men, therefore, soon tired of using their hunting knives and searched for some better sort of a tool with which to dig out the inside of the burl. There were no tools where we were camped, but one of the party found a rusty blade of a file near the site of an old barn. The end of the file was thrust into the hot coals and kept there until the metal was red hot; it was then hammered and its end made into the form of a hook. After this it was retempered by dipping the hot iron into water; then the edges were sharpened on a stone.

With this hand-made tool these wilderness men gouged out the inside of the burl so neatly that in some places one may see the light when it is held up to the sun.

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Gumption with Tools

(Continued from page 95)

The noggin or drinking cup above described hangs by a thong from my belt on all my hunting and fishing excursions. It is beautifully polished and it has traveled with me from Florida almost to Hudson Bay, and from the Atlantic to the Pacific. It is the most serviceable and convenient personal drinking cup I ever possessed and the only tools used in making it were an axe, a hunting knife, and an old rusty file, but with these tools was mixed that wonderful ingredient called *gumption*.

Among the arms hanging on my studio wall are two great knives almost as large as a machete, which my brother picked up on the battle field of Fort Donaldson. These knives were used by the Confederate soldiers and were homemade affairs fashioned from big rasp files.

For gumption and ingenuity in making emergency tools, I believe that displayed by Colonel Rose of the Seventy-Seventh Pennsylvania Volunteers was the most notable, when he planned and conducted the digging of the famous Libby Prison tunnel during the Civil War. No tools were used, but spoons, old table knives, and a bit of hoop iron.

IN FRONT of Vicksburg during its siege the U. S. Engineers were ordered by Grant to bridge a bayou. They set to work in a masterful and scientific manner, but— Well, the backwoodsmen of the Thirtieth Missouri Volunteers being idle, asked permission to try their hands at building a bridge. When permission was granted, one man swam across the sluggish current in the bayou and cut down a tree on its banks, at the same time another stalwart backwoodsman was making the chips fly from a tree at his side.

The two trees fell, their spreading branches interlacing in the waters of the bayou. Then all the Thirtieth men got busy dragging branches and brush with which they covered the two trees. On top of this they heaped sods and dirt.

The U. S. Engineers ceased work on their bridge and gladly helped the brawny frontiersmen. In a remarkably short time there was a good road across the bayou underneath which the water slowly flowed through the branches of the fallen trees and over which the troops and artillery passed in safety and comfort.

GENERAL Andy Hickenlooper built a pontoon bridge across the Tennessee River of cotton bales and a few boards from the ruins of a cotton gin.

After taking a course of civil engineering and surveying at Worrals Academy in Kentucky, it was my good fortune to get a position under General Hickenlooper. While eating lunch at Bold Face Creek, in the southwestern division of the topographical survey of what afterward became greater Cincinnati, the General told me about that pontoon bridge

General Grant ordered a bridge

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The Home Works

Gumption with Tools

(Continued from page 96)

built. General Hickenlooper asked for a regiment of soldiers; they were given to him. He made a raid upon some contraband cotton concealed in the back country, and built a bridge as described, but he told me that when the artillery went over that bridge his heart was in his mouth. Each cotton bale, as a gun carriage struck it, disappeared under water and popped up again behind the passing caisson. This happened with every gun that passed over the bridge. Nevertheless, the structure held together and the troops and artillery crossed in safety, although they did not make a dry passage.

THE Daniel Boones of our early history frequently lost the lockpins and screws that held their flintlocks on their rifles; the locks then were bound on with green rawhide. When this dried, the parts were held together tighter and safer than any screw or pins could make them; also they were repaired easily. I have one such rifle now beside me.

I also have at hand an air gun made by a janitor. The barrel is a brass tube from some piece of machinery. It is a wonderful invention. Without reloading, it will shoot 50 or 60 times with great force and precision. The pump to it is worked so easily that a little child can operate the gun without undue expenditure of effort. Every part of the gun is made of such fragments as can be found in a workshop, yet it is a better air gun than any I have ever seen.

Recently I offered a badge of distinction to any of my scouts who could go into the woods, make his own tools, and with them fashion a practical Indian arrow from the material found in the wood. Out of several hundred thousand scouts, one smashed a flinty stone against another stone, used a fragment for a knife, split and whittled out the arrow shaft, and then with the broken handle of a toothbrush, which he found in the path, he chipped a flint arrowhead. With a sinew from the body of a small mammal he had killed, he bound the flint arrow head to the shaft. He feathered the shaft with feathers found in the woods and glued them on with the gum of trees.

Alongside of this boy, Robinson Crusoe was a veritable tenderfoot, a "Cheechako." It is this indomitable will and ability to make use of the material at hand that we are inculcating in the minds of the Boy Scouts of today.

NOW the lesson taught us by these examples is, that with gumption a man can make almost anything, using only hand-made tools. It is the primitive, forceful quality of human mind backed and strengthened by modern education that produces our Fords and Edisons. This quality of mind is one of the most valuable assets we Americans possess. It means success in business, in the professions, in statesmanship and science, and it can be summed up in the good old fashioned word, GUMPTION

Wallboard and Trim *for* Finishing *an* Attic Room

By Edwin M. Love

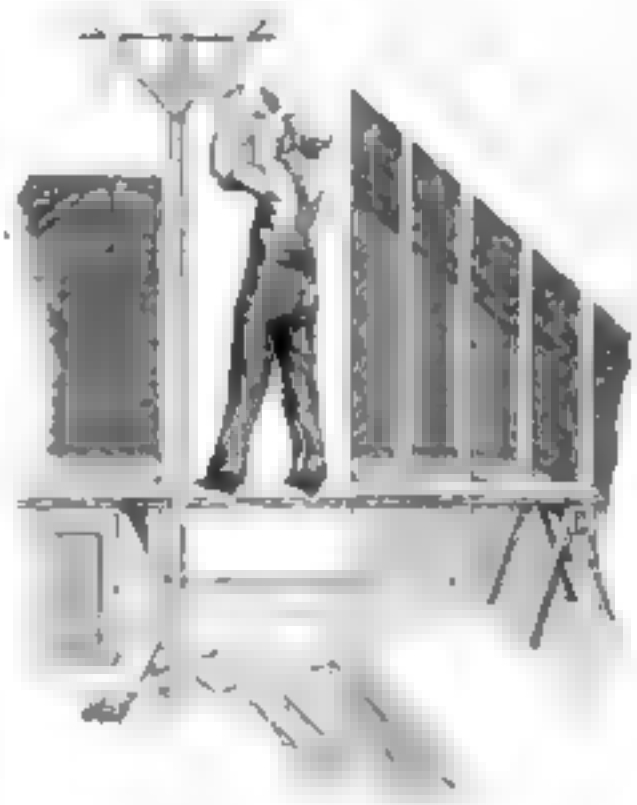
This is the fifth of a series of articles telling how to convert an unfinished attic into a comfortable room. Whether or not you wish to undertake a job of this kind, you will find invaluable pointers on home woodwork in each of the articles.

BECAUSE of its comparative cheapness and the ease with which it can be applied, wallboard is especially adapted for use by the home mechanic in lining an attic room.

Much wallboard is applied over frame walls just as erected, but to avoid humps and hollows in the walls it is advisable to test the studs with a straightedge for straightness and alinement. Irregularities may be planed out or shimmed, according to their nature.

At all angles and corners, blocks must be nailed between the rafters, ceiling joists, or studding, as may be necessary to carry the edges of the wallboard. Other backing blocks with their centers at the height of the baseboards, must be put in. Behind all light fixtures and outlets backing is required. This construction prevents pockets or gaps behind the trim.

Wallboards fall into three classes—those consisting of a plaster or composition core with fiber faces, those built up of narrow widths of thin wood and faced with fiber, and those built up entirely of wood or cane fiber suitably compressed and treated to give rigidity with lightness. Each has its good points. The plaster board is fireproof and little affected by moisture, but is brittle and heavy. Fiber boards are tough and light, but they may buckle from absorption of moisture unless both sides are given a coat of paint before using, and they are not fireproof.



The wallboard is applied first on the ceiling and then is nailed against the wall studs

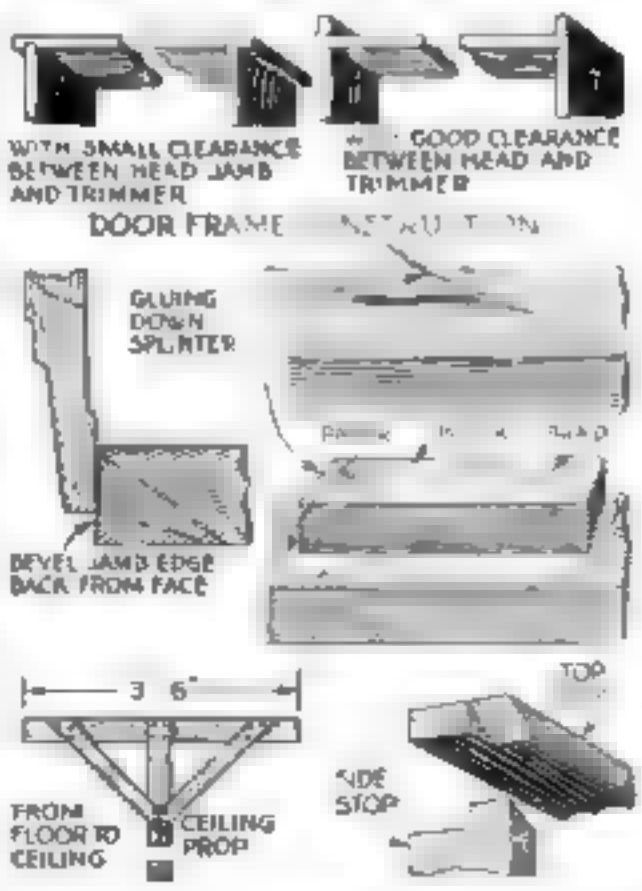
Before starting to put on wallboard, lay out the walls and ceilings for the panels, centering them, if possible, on the room or on spaces between openings, or otherwise planning for a balanced effect. Rather than have uneven panel widths, it is preferable to put in one or two extra studs where necessary.

Apply the board to the ceiling first, propping it up with one or two T-props made as detailed, and tacking the edges in a few places with flat-head nails. Strike white chalk lines to mark the centers of intermediate joists, and if the board used has a plaster center, nail every 8 in. with shingle nails. Take care not to leave hammer marks. Then nail the edge every 8 in. If fiber board is used, it is better to use patent clinching fasteners, which are nailed directly to the intermediate joists before the panel is put up. If you do use nails, drive 1-in No. 16 wire brads every 8 in. and set below the surface for puttying.

Apply the board to the walls by tacking the upper ends first, nailing the centers and then the edges. Leave the edges about 3/16 in. apart, unless the cracks are to be filled and the room is to be papered. In that case brads should be used on the edges instead of flat-head nails.

The first work in putting up interior trim is to fit the windows into the openings, so that the room may be closed up and moisture kept out. Cut off the projecting ends of the stiles from the casements and joint down the edges enough to allow the sash to be slipped

(Continued on page 106)



Suggestions for constructing door frames, cutting stops, gluing splinters, and making a prop

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2. Are the stars solid like the earth? _____
3. How was the earth formed? _____
4. Why is glass transparent? _____
5. How do we know that the earth is slowly shrinking? _____
6. What is an electric current? _____
7. How was petroleum formed? _____
8. Do electrons really move through wire when an electric current is flowing through it? _____
9. What physical changes in your body are produced by fear? _____
10. How do muscles exert power? _____
11. What are X-rays? _____
12. Can we see atoms with a microscope? _____
13. Why does heat expand things and cold contract them? _____
14. Why does the moon appear to change its shape from time to time? _____
15. What is the brain made of? _____
16. Why is it possible that the inside of the earth is growing hotter instead of colder? _____
17. Why is frost more likely on a clear night than on a cloudy one? _____
18. Does thinking use up the thinker's energy? _____
19. Which travels faster, electricity or light? _____
20. What simple test will distinguish wool from cotton? _____
21. What makes the noise of thunder? _____
22. Why would men ultimately suffocate if all the green plants were killed? _____
23. Does the boiling of water remove the impurities in it? _____
24. How do the living cells of the body get the energy with which to do their work? _____
25. How is the speed of light measured? _____

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The Home Workshop

Wallboard and Trim for Attic

into the opening against the stops or bind-stop. It is secured for the time being with finishing nails tacked into the jambs.

The door frames are built of 1 by 6 in. stock jointed straight to the width of the studding, plus the thickness of the wall-board on each side, plus 1/16 in. for irregularities. Bevel the edges back from the faces slightly to insure a close joint between casing and jam.

Since there is little clearance between the head jam and head trimmer in the entrance to the typical attic room described in this series, the side jambs are dadoed into the head rather than the head into the sides. For a door 2 ft. 6 in. by 6 ft. 6 in., make the frame 2 ft. 6 in. by 6 ft. 6½ in., inside.

To set the frame, block one side trimmer plumb and tack up one side of the frame to that trimmer, plumbing it carefully edgewise with straightedge and level. Cut a board to the width of the frame and lay it on the floor between the bottom ends of the side jambs to keep them parallel with each other and the right distance apart. With shingle points driven behind from both edges, wedge the other jamb straight and plumb, and nail solidly.

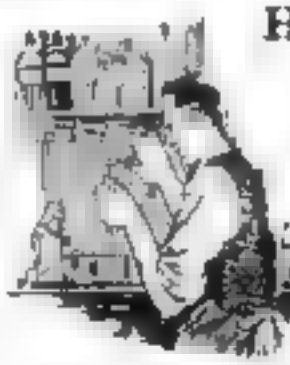
DO NOT neglect to level the head jamb carefully, cutting off the bottom of the long side if necessary. Nail up the other jamb, test for straightness, and correct irregularities with wedges driven from both edges. Then tack the stops in place.

The best type of stop for an attic room is the 3/8 by 1¼ in. round-edge door stop, as detailed. Some carpenters miter the joints between head and side stops, and some cope the sides against the head; but the best method is a combination of the two. Cut the head square on both ends to the exact length, miter the rounded edge to the depth of the mold, and split out the triangle so formed. Miter the mating end of the side stop and, following the corner of the obtuse angle, cut it square off from the back as far as the molding, as shown in the detail. Cut the stop 1/16 in. long and spring into place. The pressure will close the joint.

Since the thickness of the ordinary inside door is 1 3/8 in., the stops are placed 1 7/16 in. from the edge of the jambs, allowing clearance for paint; but the stops should not be nailed tight until after the door is hung and the lock fitted.

Next, cut to rough lengths all the finishing trim. Look it over for pitch pockets and rough places, and smooth up thoroughly. For work that is to be painted, small pitch pockets are allowable, though these must be cleaned out with a chisel and patched with a splinter of wood or a mixture of glue and sawdust.

If, in sandpapering, a splinter of wood is raised from the face or corner of the piece worked upon, lift it carefully, place glue under it, and clamp down by means of a small block tacked with brads, with a piece of paper underneath to prevent the glue from sticking it down.



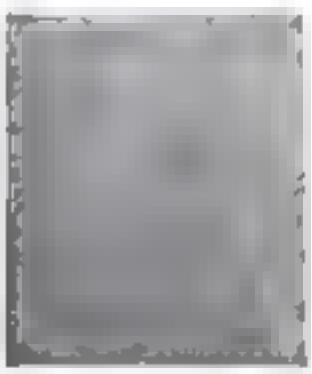
Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

ORNAMENTAL papers, especially if they are a little out of the ordinary and cannot be duplicated in the arts and crafts shops, are in demand for all sorts of decorative purposes. They can be used for covering and decorating boxes and calendars, for lining books and for making attractive novelties.

A paper that has a frosted design can be made by using a saturated solution of Epsom salts (magnesium sulphate) in water. The solution is saturated when no more of the salt will dissolve in the water

The liquid is brushed on a good grade of paper, Bristol board or cards, placed in



Ordinary paper or cardboard can be given an ornamental frosted surface simply by coating it with a saturated solution of Epsom salts. The crystallized surface will last indefinitely if protected with a thin alcoholic varnish

a horizontal position to dry. If thin papers are used, it is well to tack them to a drawing board so that they will not roll.

When the paper is dry, a frosted and crystallized deposit will be found on the surface. If it is wished to color these crystals, add a trace of dye or colored ink to the salt solution before applying it.

While this unusual design will last for some time, even if untreated, it can be made permanent with an alcoholic varnish of gum sandarac and denatured alcohol, to which a small amount of ozonized turpentine has been added. Writing or lettering can be done on the crystallized surface without destroying the decorative effect. For that reason the crystals make an interesting background for holiday cards.

SPECIALLY prepared paper may be used in forecasting the weather. Dissolve ½ gram of cobalt chloride (not the nitrate) in 50 cc. of water and add 5 grams of gelatine. Heat slowly to dissolve and use the mixture to coat a sheet of blotting-paper. Normally the color of this paper will be pink, but it changes to blue in very dry weather and to a violet tone in moist weather.—ERNEST BADE, Ph.D.

Bow Used for Shooting Toy Parachutes into the Air

SHOOTING arrow parachutes is a sport to thrill young bowmen who are looking for something novel in the way of archery.

Remove the cover from an old umbrella, being careful not to rip the cloth. Cut the cover around on a line halfway from the outside to the center so as to reduce its size and weight. Place a piece of stout canvas over the central hole and sew it securely in place.

For the arrow you will need a straight stick a little longer than the usual target arrow. It should be about 1 in. in diameter, tough and well seasoned. Wrap one end for about an inch with fine stout wire. Drive the points of the wire into the wood so that they cannot cut your hand

How to make the parachute and bow

Fasten the center of the parachute to the stick with a small screw or a large carpet tack. Tie lengths of a strong fishing line to the corners of the cover and attach the cords to the arrow at about the halfway point. A small notch will keep the string from slipping

If no strong bow is at hand, you can make one from a locust sapling 1 in. in diameter and a piece cut from an inner tube. The rubber should be 1 in. wide and one-third as long as the sapling. This combination makes a powerful bow.

After being shot vertically into the air, the parachute opens and the arrow descends slowly and gracefully to the ground. —H. E. WEINRICH

Paste for Imitating Carving

OLD picture frames, glove or work boxes and similar pieces may be decorated easily with imitation carving.

Rice is boiled in water to make a thick paste and mixed with starch to a dough-like mass, which is rolled into sheets, cut into squares, and allowed to dry.

A mold then is made. One simple method is to heat gutta-percha in warm water until sufficiently soft to be pressed over the carving that is to be duplicated.

Place the previously prepared squares between damp cloths until they are moist enough to be kneaded into a doughy mass and press the material into the mold.

The finished work, which looks very much like ivory, is glued in place.—W. J. E.

We Make a Winged Toboggan

(Continued from page 72)

it would take a rather high rate of insurance.

Harley and I dragged it up the mountain the next afternoon to our preferred starting point, which was about 500 ft. above the camp. He had bargained to try it first. But I liked Harley Tryon, and inasmuch as the idea and workmanship had all been my own, my conscience became apprehensive. I was afraid to try it first; so was he, though neither of us would admit it to the other then, although we did later.

We flipped a coin, and it was still his turn first. But suppose the thing actually did fly and had a crash! I hated to think of all that work being lost in a first flight crash, and I wouldn't get a chance to ride it. So we compromised and decided to ride it together the first time down. We should have preferred also to compromise on the distance of the first tryout, but could not, because the mountain was so steep that we had to go up to the certain point in order to get a footing to climb aboard.

Harley always had ridden behind to do the steering. We took the same position; although now I was in the "cockpit," and couldn't roll clear of the thing if it became necessary or desirable.

WE CLIMBED on. That hill never had looked so high and steep, nor the frozen crust so hard and smooth.

"Are you ready?" Harley called. I answered, and we started.

The pick-up was immediate and terrific, with the sensation in the stomach of going down in an elevator. Faster, faster! The tears were streaking across my temples from the icy wind. I couldn't breathe, or at least didn't, in the excitement. Only one thought remained—*hang on!*

Two-thirds down we struck a small drift, and for a hundred feet beyond, though it was less than half a second in time, there was no sound of the toboggoplane's scraping the frozen snow. At the speed we were going the actual lift was small, but the fact that it actually had lifted us for a 100-ft. jump was demonstrated by our tracks.

At the bottom of the hill was a lake, 1000 ft. across, frozen and covered by 20 ft. of snow or more. We coasted across this flat to the far side, started up the opposite hill, and soon stopped.

The next time Tryon went alone. He sat well forward in the cockpit, and halfway down the hill there were unmistakable signs that the *Dragonfly* was going to leave the ground. When Harley reached where the bottom should have been, he was 10 ft. off the ground going like a shot. He landed straight and even, and finally came to a stop.

After that we alternated rides, with more or less good natured rivalry for height, distance, and near-accident risks. The sport never became dull. It was never even reasonably safe on such steep hills. It never failed to offer a

(Continued on page 104)

We Make a Winged Toboggan

(Continued from page 103)

new kick in each descent, or flight, as you please.

Fifteen feet off the ground was perhaps the maximum attained, but considering the speed and the construction of the machine, that was plenty.

Between 25 and 30 trips were marked up before the crash. Confidence and the almost inevitable contempt of danger through familiarity, brought the sport to a sudden finish.

It was early in April, 1925, three months before any signs of spring appear at that altitude, when the *Dragonfly* made its last flight. A light, gusty wind was blowing. Harley went down the first trip, and after coming back up the hill warned me to look out for the breeze.

I sat as far forward as I could upon starting, and the irregular air pressure on the way down made me hesitate, but it was too late. When nearly to the bottom I slid back, but I had waited too long and slid back too far. The front of the machine raised to a horizontal position, and then kept right on going up.

I had some recollections of bending my head back and seeing the snow above me, about 20 feet away, and then we started for each other, the snow and I. The next I remember, some one was pulling on one of my legs, which were the only part of me I could move. Everything was crammed with snow—eyes, ears, nose, mouth, collar, and I couldn't get my breath. Harley told me later that the toboggoplane had just kept right on rising, and when well upside down I had left it and plunged head first through the crust into the snow.

Something like that must have happened for my face was like a piece of raw beefsteak for two weeks. I was thankful that the crust had broken at all, as it was hard enough to support the heaviest man without giving way.

The *Dragonfly* came down sideways and crumpled a wing. The next few days we stayed inside, and a snowslide came crashing down our favorite speedway, which closed toboggoplaning for the season—perhaps forever.

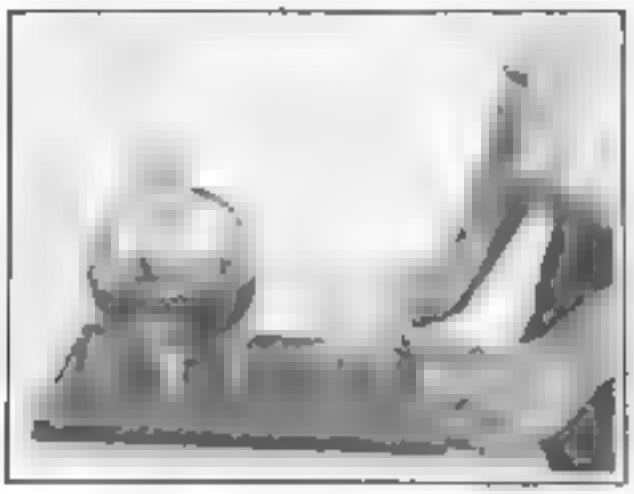
While there is no question about the danger of making one of the toboggoplanes for use on mountains such as Mr. Keating describes, the addition of wings to a toboggan will add immensely to the sport of coasting on ordinary hills. The toboggan skims along the snow much as a hydroplane rides on the water, and at moderate speeds there is no danger of its rising far in the air.

Glycerine and Alcohol Prevent Frost Forming on Glass

THE formation of frost on windows can be reduced materially by rubbing the inside of the glass with a solution of glycerine and alcohol. The solution is made by dissolving a teaspoon of the glycerine in half a pint of alcohol. Apply the mixture to the glass with a clean rag.

The Home Workshop

Common Corks Used in Making Stands for Glassware



IN ANY home workshop, kitchen, or laboratory where flasks, jars, and porcelain-ware are filled with hot liquids, the danger of breakage may be lessened greatly by the use of a stand made by fastening corks with glue and nails to a wooden baseboard.—J. H SCHALEK

Sharpening Your Skates

Continued from page 82

Hollow filing is a little more difficult but it can be accomplished with the tool illustrated in Fig. 4. A round file of large enough diameter to cut a very shallow depression in the length of the runner is essential. Cut two hardwood blocks about ¾ in. thick, 1½ in. wide, and 6 in long. Make notches near one edge to take the file and then fasten the blocks securely to a third piece, the top, so that the space at the bottom forms a slot that will slide closely over the thickness of the skate runner. The file can be held in the blocks by a setscrew or a bolt fitted down through the top. Fit the appliance over the skate and sharpen the runner by pushing forward just as if you were planing a board.

Fig. 6. Two types of holders for files

Where an emery wheel can be used, an excellent job of hollow grinding can be done with the jig shown in Fig 5. This fixture is nothing more than a vertical piece of board fastened rigidly to a baseboard. The top edge of the vertical piece then is cut out to fit snugly in the openings of the skate frame. A steel plate is drilled so that it may be fastened over the skate with screws. It should be arranged so that the runner will come halfway up the cutting face of a 4- or 5-in. emery wheel.

By pressing the runner lightly against the rapidly revolving wheel and moving the jig along from side to side, a professional job of hollow grinding will result.

Figure 6 shows in detail the blocks used in Figs. 3 and 4.

Use only the best quality files for skate sharpening. An 8- or 10-in. mill bastard file usually is chosen for this work.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Home Workshop

Drawing-Table for the Home

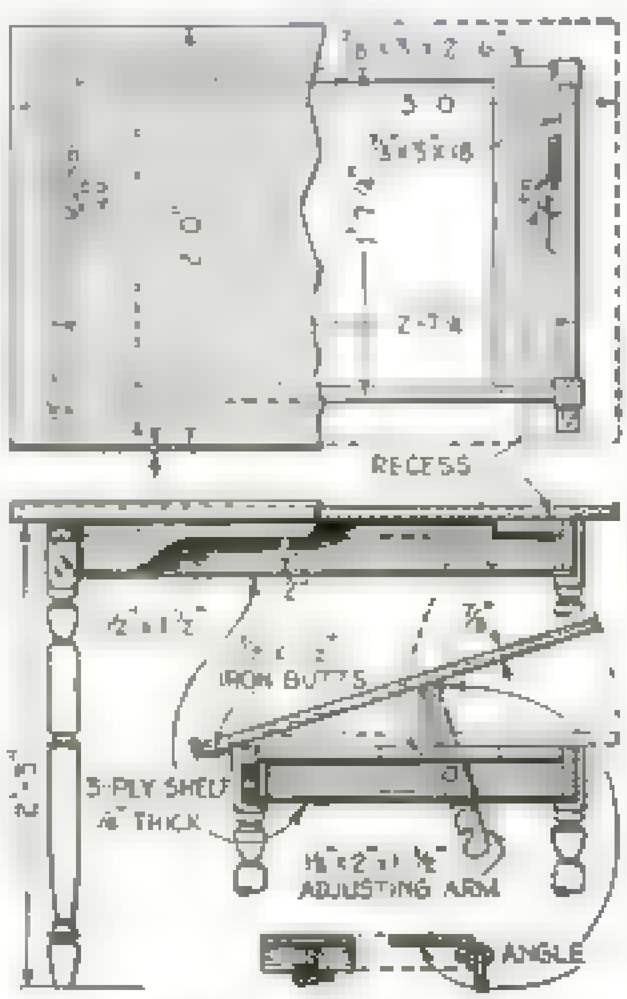
EVERY home mechanic, no matter if he specializes in wood or metalworking, often has occasion to make a working drawing, sketch, or layout. For such work it is helpful to have a well equipped drafting-table. A good model is that illustrated, which is remarkably rigid, considering how light the construction is. When not needed for drafting, it will serve other purposes, as the top can be dropped flat.

This adjustable table has storage space for all the materials used by a home draftsman

The table is constructed of any soft, clear wood obtainable or an unfinished kitchen table can be purchased for a few dollars and remodeled.

The side and end rails are constructed from 1-in. stock dressed to ⅞ in. and are all 8 in. wide. Each end rail is 18 in. long and has a tenon cut at each end to fit a corresponding mortise cut in the legs.

[Continued on page 107]



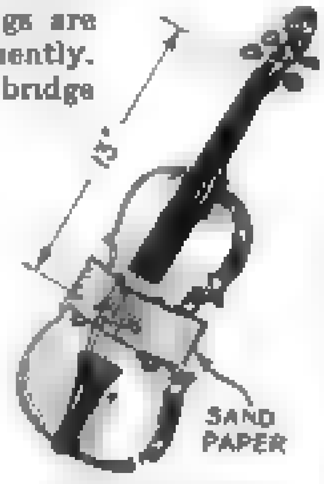
Top and front views of the table and end section showing the adjusting mechanism

The Home Workshop

Fitting a Violin Bridge

ALTHOUGH a violinist usually goes to a violin-maker to have a new bridge fitted to his instrument, the work can be done by almost any one.

Place a piece of No. 000 sandpaper, as shown, with the abrasive side up, and move the bridge from side to side until the legs are sanded down sufficiently. The curve of the bridge legs will conform to the curve of violin and will bear perfectly.



Location of bridge

The distance marked 13 in. on the drawing, which shows full-size violin, should be 10 3/16 in. for a three-quarter-size instrument, and 10 1/16 in. for a half-size model.—GEORGE A. MOHL.

Drawing-Table for the Home

(Continued from page 106)

Dowels may be used in place of the mortise-and-tenon joints, if preferred.

Both side rails are 30 in. long and are joined to the legs the same way as the end rails. The front rail has a portion cut out as shown to provide access to a sheet of 3-ply veneer, which is fastened to the lower edges of the rails to serve as a shelf.

The legs are turned on a lathe or made straight, as desired. The rails and legs are assembled with a good grade of flake or liquid glue and after they are thoroughly dry, a strip 7/8 by 4 by 17 1/4 in. is fastened in place at each end, flush with the rail tops. These pieces have mortises to provide clearance for the adjusting arms and the nuts that hold the arms to the angle irons fastened under the top.

A round-headed wood screw having a shank about 1/4 in. in diameter and projecting 1/4 in., is located in each end rail about midway between the edges and 10 3/4 in. from the outer edges of the front rail; it is to engage the notches on the adjusting arm.

The top is built up of 7/8-in. boards and is 24 by 36 in. A strip 1/2 by 1 by 36 in. with its ends beveled, is secured to the front edge of the top to prevent the drawing-board from sliding off when the top of the table is inclined.

Two small iron angles made from 1/8-in.-thick stock are recessed into the top on the under side where shown and fixed with screws. Two 1 1/2 by 1 1/2 in. iron butt hinges also are located on the under side of the top. The two iron adjusting arms are made from 1/8-in.-thick stock and are secured to the angles located in the top by means of small, round-headed stove bolts.

The table shown in the photograph has a small auxiliary shelf 5/8 by 6 by 24 in. on each end, supported on 4-in. pressed-steel shelf brackets and provided with a stop on the inside edge between the legs.

When completely assembled, the table is cleaned up with fine sandpaper and finished as desired.—W. J. E.

Operating a Model Railroad by Electrical Controls

(Continued from page [illegible])

are controlled electrically by eight push-buttons by the method described last month, it is possible to run two trains in opposite directions continually on either the outside or the inside track. The cross-overs, of course, act as sidings.

But you will need some control over the speed of the individual locomotives. In other words, you will have to be able to stop either train without interfering with the operation of the other one. Otherwise it would be impossible to run one train onto a siding and have it wait there while the other train goes by on the main line.

In Fig. 2 you will note, in addition to the track layout, that a switchboard is shown. This switchboard differs from the one you will need to control the track switches only in that switches to control the current to the track must be so built that you can leave them in either the open or closed position. They can be of ordinary porcelain-base, knife type, or if you wish to do an especially neat job, you can construct a panel with some of the push-pull or toggle switches sold as filament switches for radio sets.

When all of the switches are in the closed position, current is being supplied to all sections of the track.

Assume, for instance, that you are operating two trains in opposite directions on the outside track. The buttons are pressed to throw the switches so that the train to reach the siding first will be switched onto it, and a switch is thrown, cutting off the current from the track of the siding. The train goes on the siding and stops. A button is pressed to close the main-line switch and the other train goes by. Then switches are closed and buttons pressed to bring the freight out on the main-line track again and speed it on its way.

Even if you do not attempt the construction of any electrically controlled switches, it will prove well worth while to install the sectional control of the track as shown in Fig. 2. Such problems as running two trains in the same direction on the same track are simplified greatly if you are able to cut off the current from any section of the track without disturbing the rest of the system.

Suppose, for example, that you wish to run two trains so that one follows another. Put the faster train in front and when it gets too far ahead of the second train, stop it at a station while the other train picks up the lost ground. Or you can keep the faster train just behind the slower train by momentarily opening and closing the switches controlling the current to the track sections over which the faster train is passing.

There are almost endless possibilities for the development of electric control for model railways and, luckily enough, the main requirement is time, since bell wire, knife switches, and other supplies, are quite cheap.

The Shipshape Home

How to Lay New Floors

KEEPING the floors of a home shipshape is a perpetual problem, especially if the wood is of a poor and splintery quality, or if the floors have been abused or neglected. When the floors are in really bad shape, they must be relaid. Fortunately that is not a difficult job. It is one you can do yourself with a saw, hammer, and square, provided you are willing to take a little time and pains.

The popular material for wooden floors just now is oak, which makes a much finer looking surface than yellow or North Carolina pine, although it is more expensive. Maple also is used. My own preference is for oak, as I believe that the additional expense for material

can be disregarded when one is doing the work himself and consequently saving the cost of labor.

There are at least four thicknesses of flooring from which to choose. As your old floor probably is worn so unevenly as to have depressions here and there, it is better to use rather thick stock for the new floor to prevent the boards from springing. The ⅜- or ½-in. thickness is perhaps the most practical. In estimating your flooring at the ⅜- or ½-in. thickness, allow 50 per cent more than the actual area if the boards are to be 1½ in. wide, or 33 1/3 per cent extra if they are 2¼ in. wide. The narrower flooring is, of course, the better

Have the old floor dry. Do not mop it beforehand, but sweep it clean. Lay damp-proof paper over the old floor—not common building paper, but some kind that really will stop dampness from coming through.

Lay the new boards at right angles to the old floor boards, after nailing down as solidly as possible any loose or springy places in the old floor

Start the first board by placing its groove to the wall after having removed the quarter-round or base-shoe molding Do not, however, push the first board tightly against the base. Leave a space of ½ in. to allow for any possible expan-

(Continued on page 110)

(Continued from page 109)

son later on. The molding will cover this opening when it is replaced.

For the same reason do not cut the boards too long; they need not be exactly correct in length, as the molding will conceal any irregularities. Endeavor, as far as possible to use boards that will go right across the room in one piece. When shorter pieces must be used, be sure that the joints in two adjacent strips do not come opposite each other.

The boards are fastened by what is known as blind nailing; that is, the nail is driven at an angle through the board, starting just where the tongue joins the edge of the board. The angle should be about 50 degrees from the horizontal.

Sixpenny wire finishing nails, which are obtainable at any hardware store, may be used for ½-in. flooring, or a smaller size of cement-coated nails. Regular cut flooring nails should be used, if they can be had, for ⅞-in. thick flooring.

The nails should be spaced not farther than 16 in. apart and if the board is at all warped, it is advisable to place the nails closer together, say 12 or 14 in. It is most important not to damage the face of the boards with the hammer. A punch may be used to drive the nails home if any difficulty is experienced.

If the tongue of a board is broken or battered, it should be broken off carefully with the claws of the hammer so that there will be nothing to prevent the next board from closing tightly.

After the floor is well started, so that there is little danger of moving the boards already laid, a piece of waste flooring or a length of two-by-four may be placed on the old floor against the tongue of the piece being laid, and hammered hard enough to force the new board into place. Be careful, however, not to damage the tongue.

On laying the last board, leave a space for expansion, as in the beginning. If this is not done and the floor becomes damp, it may bulge up at some point with such force as to pull the nails. There is then no way of repairing it except to relay the floor.

The next step is to scrape the wood to make the joints perfectly smooth. This is done with a steel scraper, preferably of a handled type. Scrapers may be made, however, from mowing-machine sections or from old saw blades. Scraping is hard work and perhaps it is advisable to have a professional floor-finisher come in with machines to do the surfacing, if there is one in your locality. Even unscraped floors, if of oak, will be much better than the average floor found in ordinary new dwellings.

The boards next are sandpapered by placing a sheet of No. 1½ sandpaper around a flat-surfaced block. The dust must be removed by sweeping and wiping or with a vacuum cleaner.

If the floor is of clear selected oak, a natural paste wood filler should be applied according to the directions on the container. Cheaper grades, which show

(Continued on page 111)

The Shipshape Home

(Continued from page 110)

sap flaws, require a light golden-oak shade of filler.

A thin solution of burnt umber and turpentine then may be applied to the light pieces to bring the flooring to an even color. When the filler has dried flat, which takes about half an hour or less, it must be rubbed off across the grain with a cloth, excelsior, or oakum.

Allow the filler to dry hard before applying the first coat of finishing material. This may be floor varnish or white shellac. At least two coats of varnish or two coats of shellac, followed by a coat or two of floor wax, should be applied. The varnish also can be waxed, if desired.

An old, heavy cotton mitt of the padded kind is useful for applying the wax. Spread as even a coat as possible and when the floor is covered, go back to the beginning and start polishing. A floor brush of special design for polishing is easiest to use, although cloths or a dry mitt will serve. If the cloths are wrapped about a heavy flat-iron or other weight, the labor will be lightened. The finishing strokes should be with the lay of the board. Hard rubbing is necessary.

While a good grade of floor varnish gives a harder surface than wax over shellac, it is more difficult to patch any worn places.

Protecting the surface is what counts in the life of a floor. If you go to the trouble of laying a good floor of this kind, it certainly pays to spend the little time necessary to see that the finish is never worn through.—George G. McVicker.

Stopping Doors from Rattling

While rattling doors, which cause annoyance in many houses, can be fixed by the method of moving the strike plate in the door jamb toward the door stop just the right amount, it often happens that the amount of play in a door is so slight that one wishes for a still simpler remedy.

To move the strike plate even a trifle involves chiseling the mortise wider, plugging the old screw holes, and then, if the distance has not been gaged exactly right, filing the plate enough to allow the catch and lock to enter their slots.

A screw takes up all the "play"

The same effect can be obtained, although it is perhaps not so workmanlike a repair, by inserting a common wood screw into the narrow face of the door stop as shown, opposite the lock. A slight turn of the screw will give the correct adjustment to prevent rattling.—E. Crosby Doughty.

Better Shop Methods

(Continued from page 76)

Old Bill Says—

KEEP objects from under the toolpost washer; they may cause trouble when you are turning a piece of work within close limits.

If the belt is slack on your lathe or on any other machine, have it taken up.

Some workmen never seem to have the slightest notion of what it costs to run a machine shop. They must think the tools can be bought at a 10-cent store.

Old Bill, machine-shop foreman

The first step in setting up a job is to think out the easiest and quickest way to do it.

A drill press table full of holes or a lathe faceplate cut up are unsightly and the badge of poor workmanship; both can be avoided with a little care.

Every job or piece of work you do is a personal advertisement, and it is up to you whether it is a good or a bad advertisement.

When a drill squeaks in the hole, it is often a sign that the side clearance has been worn away. Trying to force the drill in this condition may result in breaking it.

Carbon tool steel is often superior to high speed steel for putting a good finish on work.

If you remove the center from the headstock of your lathe for any reason, always plug the hole with a piece of clean waste or a rag to keep out the dirt.

A flat drill will drill certain hard, tough materials easier and faster than a twist drill.

Burnishing Broach Gives High Polish to Brass Bushings

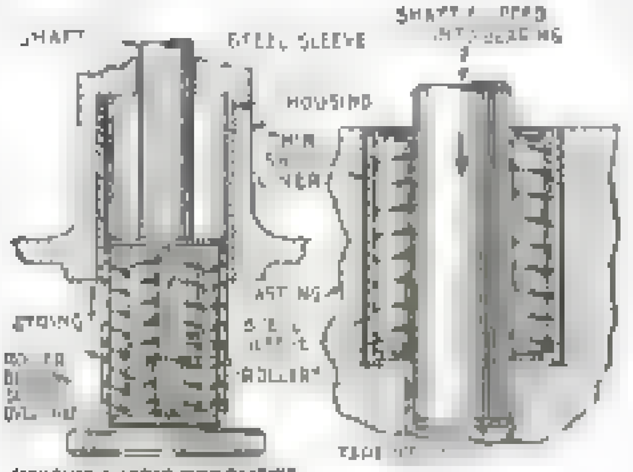
BRASS bushings and babbitted bearings may be sized accurately and given a high polish by using a broach made as illustrated rather than by reaming. The tool is used in an arbor press and simply is forced through the work. It will do faster work than a reamer, and on soft metals will leave a finish beyond compare. It is made of tool steel, hardened and highly polished. The first tooth should be ground .015 in. under size and the remaining teeth should taper up to the finish size on the last three teeth.—H. L. WHEELER.

Better Shop Methods

Tricks that Are a Help in Repairing Roller Bearings

ASSEMBLING roller bearings of the spiral type usually can be accomplished quickly if advantage is taken of several little kinks that simplify the work

Before slipping a housing over a bearing, the rollers open up and will not enter the bore. There is no room to place a shield or tin ring around them, but it is necessary only to tie them tightly to the shaft with one turn of ordinary string. This will hold them until the housing has been drawn over them and then the soft



String used to hold rollers together (at left) and liner for taking up play (at right)

string will tear without interfering with the proper functioning of the bearing

To slip a shaft into a roller nest, there must be a taper on its entering edge. If the shaft end is not tapered, break down the corner with a file

The replacement of an auto bearing is often costly. Roller bearings of the type illustrated usually are used with a split steel sleeve and the wear may be on the inner surface of this sleeve or on the surface of the shaft itself. In either case, the total amount of wear should be determined. If it is desired to save the expense of a new bearing, take up the play by inserting a thin sheet metal strip behind the steel sleeve, as shown. This steel shim stock can be obtained in any width and thickness.

When deciding the thickness of shim stock necessary, make allowance for a few thousandths play. The writer has reshimmed bearings of this type as often as three times. Thin brass also is suitable for shim stock, but in no case use paper —J. V. R.

Drilling a Bent Hole

IN THE experimental department of a large plant in Philadelphia, the hydraulic engineer required a ¼-in. hole drilled in a piece of copper, as in the lower view. This was accomplished by first making a templet and bending the copper, as shown in the upper view.

The hole was drilled, tapped at each end for a plug, and filled with sand. After that the bar was reheated and straightened.—V. K.

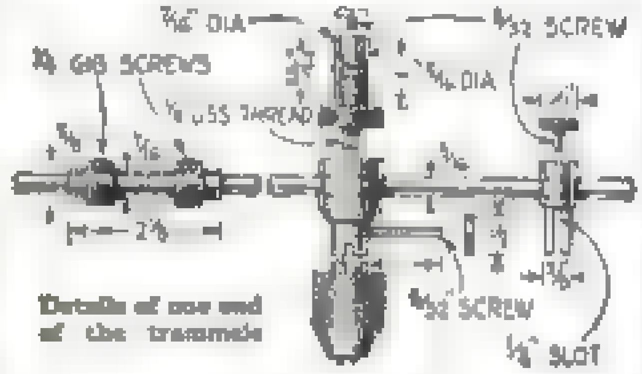
Better Shop Methods

Two Cheap Tap Wrenches Used in Making Trammel Points

TWO tap wrenches bought for 25 cents each were used in making the machinist's trammels illustrated. The wrenches are clamped to the beam, which is flattened on top, by means of knurled screws.

One point has an auxiliary screw for fine adjustments.

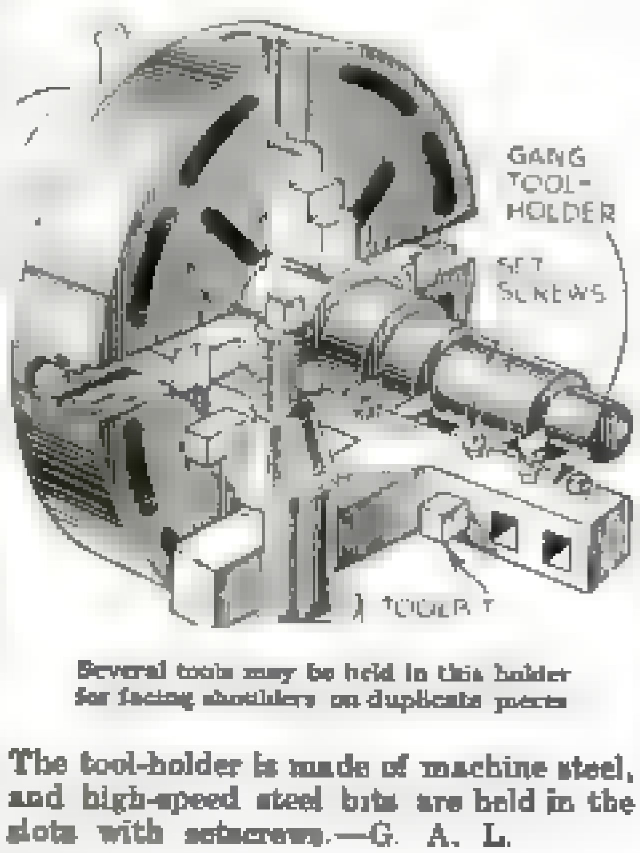
A swivel handle at the top of each tram is an advantage, as it enables the trams to be swung around more conveniently. The points and caliper legs can be made to suit individual needs.—D. T.



Details of one end of the trammels

Gang Tool-Holder for Facing Shoulders on a Lathe

FACING several shoulders on repetition work can be done at the same time with a gang tool-holder such as is illustrated. This effects a saving of time and assures that successive pieces will be duplicates.

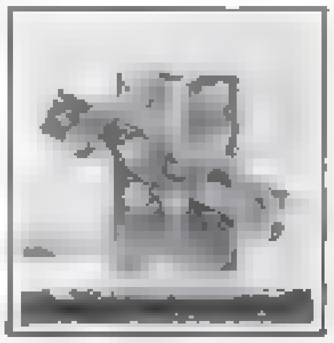


Several tools may be held in this holder for facing shoulders on duplicate pieces

The tool-holder is made of machine steel, and high-speed steel bits are held in the slots with setscrews.—G. A. L.

How to Avoid Failure in Making a Sine Bar

FROM the standpoint of the machinist or toolmaker who has to make a sine bar, the design illustrated below has the advantage that there is no danger of grinding and lapping the center distance under size, which would entail scrapping the work.



Set up for use

If it should be ground or lapped under the finished size, the button-resting surface opposite the 35-degree angle is ground or lapped a sufficient amount to correct the error. The same means may be used to correct the bar if at any time it should "go out" because of the distortion of the steel. This cannot be done with an ordinary sine bar.

The buttons may be flush with the sides or left projecting at one side, as desired. When flush with the sides, they do not permit as great an angle to be measured, but they will serve all ordinary

Details of a sine bar which may be made larger or smaller to meet special conditions

purposes, as the bar may be used with either side to the angle plate.

The button distance may be increased if a larger bar is required, but the 3-in. size is handy for small work. The holes for the screws that hold the buttons are at an angle of 45 degrees. The plugs and bar should be made of a good grade of tool steel, hardened, ground, and lapped all over with the most precise accuracy.—E.T.W.

Wire Clips for Lamp Cords or Air-Hose Lines

PORTABLE lamp cords, air hose, and other flexible lines, such as those carrying coolants to machine cutters, often are fastened temporarily in place with bits of wire or pieces of cord, although the practice admittedly is not workmanlike. It is much better to use clips or hangers.

By bending ½-in. spring steel wire as shown, a type of clip may be made that can be attached to all kinds of supports and put to many different uses. As any scraps of steel wire can be used, a set of these clips need not cost a cent. —GEORGE A. LUERS.

Better Shop Methods

How to Make a Press for Relining Brake Bands

By Frank N. Coakley

FOR the garage man or other mechanic who has a great many brake band renewal jobs, the press illustrated is well worth making. No patterns or castings are required. All the parts are especially heavy so that the press will stand hard usage and will serve for other purposes. The maker can use his own judgment in the matter of sizes, however, and be guided by his own requirements and the scrap material available in the shop junk heap and elsewhere.

The main frame is a length of 10-in. I-beam. It either is set in the floor in concrete or fastened to the end of a bench. To the top of the beam a ½-in. plate 2 in. long is riveted. This plate supports the 3½ by 7 in. angles, that act as the side guides and the fulcrum plates for the top lever. This lever is 2 ft. 6 in. long between the centers of the pinholes. The ram end is drilled for a ½-in. pin. The rod end is provided with a ½-in. hole.

Side view of press and section through ram

Regular brake-rod ends can be used as connections for the pull rod, which is provided with a turnbuckle for adjustment. The pedal is built from a piece of ½ by 2½ in. flat steel. A small piece of angle is riveted to the end to provide a foot rest. A piece of 3½ by 7 in. angle is riveted to the beam to act as a fulcrum point for the foot lever. A spring is provided as shown to act as a pull back for both the top and the bottom levers.

A shelf made from a piece of 6 by 6 in. angle is riveted to the beam 2 ft. 6 in. from the floor. A hole is provided through which the riveting block pin projects so that it will be kept central.

The ram of the slide is made from a piece of 2 by 3 in. flat steel. A hole is drilled in the bottom to hold the riveting punch, which is held in place by a setscrew. The top end of the ram is rounded to allow the top lever to slide on it easily.

A strip of brass is placed between the ram and the beam. A piece 2 in. square is bolted between the two side angles and acts as a front plate. A slotted hole is provided in the lower end of these angles to allow a pin in the ram to slide up and down. To this pin two springs are fastened to act as a pull back for the ram.

GLASS may be filed with comparative ease if the work is done under water. This insures that the file will not become dull so rapidly.

Better Shop Methods

Clamping Fixture for Filing Small Pieces at an Angle

FILING an angle on a large number of small pieces often may be made easier by the construction of an auxiliary clamp or fixture of the type illustrated. This is a piece of flat steel bent to suit the work and held in the bench vise. The band should be such that the two sides of the fixture will be approximately parallel when the vise jaws are closed upon them.

Elliptical Shaper Tool Insures a Smooth, Shearing Cut

SQUARE-NOSED tools tend to dig in when finishing tool steel, or alloy steel in the shaper or planer, which makes it difficult to produce a smooth surface. The tool shown, if used for this purpose, will insure a good finish.

A finishing tool

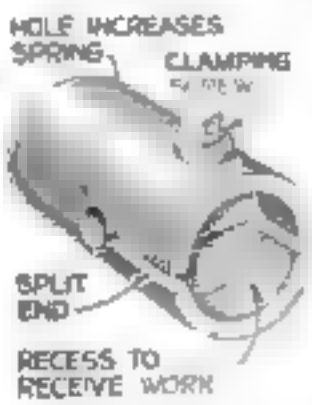
It is forged in one piece of the best grade of carbon tool steel, high speed steel not being recommended, and is tempered in the usual way.

In section it is slightly elliptical, and is ground at an angle of about 5 deg. so that the cutting point is about midway of the blade. This gives a shearing action

The tool is to be used only for finishing with a light cut and a fine feed. Use oil for best results.—H. L. W.

Chuck for Round Blanks

GEAR blanks or similar work, may be handled very rapidly and accurately for facing or reaming in the chuck illustrated, which is gripped in the usual four-jawed chuck. The spring hole is drilled, the end split, and the clamping screw is put in before the the hole for the blank stock is bored. The clamping screw is tightened a little before boring so that the chuck will release the work readily when the screw is loosened. This type of chuck may be used again if it is trued up carefully at the first setting, or it may be bored out when necessary to take a blank of larger size.—S. W. BROWN.



A quick-acting chuck

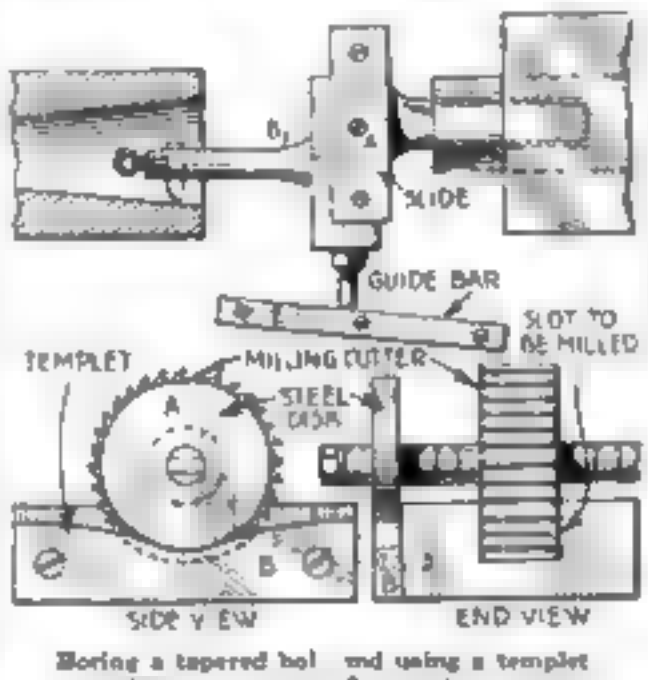
This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Easy Shop Kinks

Two Ways of Simplifying Difficult Milling Jobs

ON OCCASIONS when it has been necessary to bore a tapered hole with a milling machine, I have used the method shown in the upper view of the accompanying illustration. The guide bar was set on an angle corresponding with the desired taper and fastened to the milling-machine table in the most convenient manner. An adjustable boring head of a common type without transverse screw adjustment was inserted in the spindle to carry the boring tool.

The head slide was provided with a contact piece to strike against the guide bar at each revolution of the spindle. The work was advanced with the finest



Boring a tapered hole and using a templet in milling a groove of irregular contour

possible feed and the slide, of course, followed the guide bar much the same as a cross slide follows a taper attachment on a lathe. A similar set-up can be used on a drill press when you wish to bore a tapered hole.

Another kink I have used is the method of cutting irregular contours in odd shaped pieces and cams that is illustrated in the lower view.

In this instance a groove had to be cut in a steel block. A templet was made to correspond with the desired shape and attached to the piece to act as a profiling guide. A steel disk of suitable diameter was put on the arbor with the mill and so located that it rested on the guide plate when the mill was in a position to make the cut. The templet was held in contact with the disk by manipulating the vertical and table feeds of the machine.—CHARLES KUGLER.

Making Special Nuts

SO MANY uses are found for hexagon stock that it pays even a small shop to keep on hand a few bars of the more common sizes. This stock is especially useful when special hexagon nuts are needed. The only work required is to drill and tap the holes and cut off the nuts, facing them afterward on a thread arbor. This is so much quicker than machining the entire nut that the time saved more than warrants the expense of carrying a few bars of stock.—H. L.

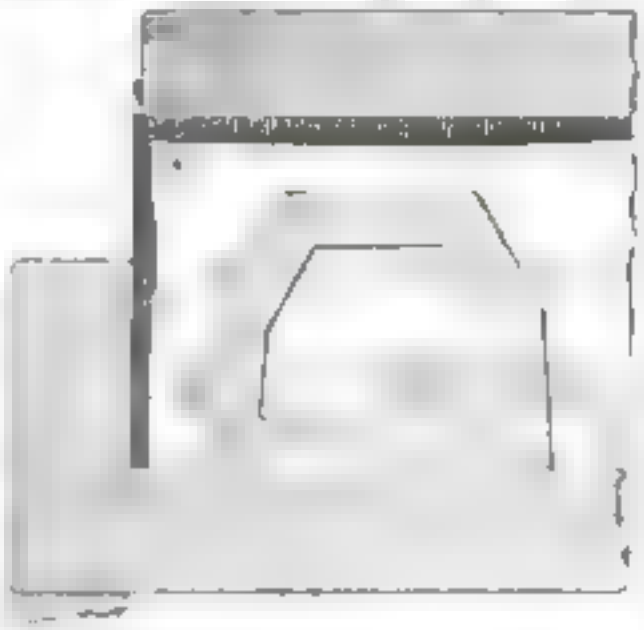
Better Shop Methods

Draftsman's Templet Saves Time in Drawing Threads

DRAWING screw threads, which is a time-consuming detail in the work of every mechanical draftsman, can be expedited by the use of a templet made as shown of celluloid, wood, or hard rubber.

A piece of material 1/16 by 4 by 5 in. makes a templet of a handy size, but the dimensions can be larger or smaller, to suit the individual requirements.

The angle on each side of the upper half of the templet is 30 degrees from the



Threaded parts may be drawn quickly, as machine details with this drafting templet

perpendicular and is used in drawing the thread proper. The angle of the sides on the lower half is 4 degrees from the perpendicular and is used to draw lines representing the pitch. The inside and outside angles are the same because often it is convenient to use both at once.

While the angle representing the pitch is not correct for all threads, it is a mean between a standard ¼-in. and a 1-in. thread and is as accurate as ordinarily is required for routine mechanical detailing.—BOYD R. ALVORD.

Easily Made Expanding Collet

FOR facing small pieces in a lathe, the expanding chuck or collet illustrated below is especially useful.

A length of round stock is turned at one end to suit the work to be held, the reduced section being slightly shorter than the thickness of the pieces. A hole

A simple chuck of expansion type for holding small pieces that are to be faced in a lathe

is drilled and reamed in the end of the collet to take a taper pin. Another tapered hole is run into the first hole to take a knockout pin. The end finally is slotted as shown.

In use the work is placed against the shoulder and the taper pin is driven into the end hole.—R. H. KASPER.

Money Making Opportunities for Popular Science Readers

Readers of POPULAR SCIENCE MONTHLY will find scores of opportunities in this section (pages 120 to 150) for making more money.

Every reader of POPULAR SCIENCE MONTHLY *is invited to enter this contest—*

$100 in CASH PRIZES

For the best letter of 150 words or less answering the question—

"What advertisement in the 'Money-Making Opportunities' Section interests you most—and why?"

we will pay on February 10th, the following cash prizes:

First Prize	$50.00
Second Prize	25.00
Third Prize	10.00
Fifteen Prizes of $1.00 Each	15.00

First read every advertisement in the Money-Making Opportunities Section on pages 120 to 150. Pick out the one that interests you most and then write a letter—not exceeding 150 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on January 1st. The prize winners and their letters will be published in the March issue of POPULAR SCIENCE MONTHLY.

Address your letter to

Contest Editor
MONEY-MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

From an Idea to the Greatest Man-Building Institution in the World

—And What It Means to Men Who Want to Attain Independence

By J. E. Greenslade

REQUESTS for more than 50,000 salesmen were received by the Employment Service Department of the National Salesmen's Training Association during the past 12 months.

Wholesalers, manufacturers, jobbers and other employers of salesmen all over the North American Continent continually recruit their salesforces from the ranks of N. S. T. A. Members.

Surely this is unquestionable proof of the great demand for salesmen and a great tribute to the Association. And yet, only a little over eighteen years ago this great Institution, headquarters for Scientific Salesmanship, was but an *idea*. Today the Association can number its Members in the tens of thousands, all over the English speaking world—and thousands of them have attained financial independence as a result of the training they received with the Association.

Read What They Did

$12,000 a Year

A. H. War[illegible], Chicago, left a small [illegible] job. Now he averages $12,000 a year as a salesman.

$150 to $800 a Month

W. P. Clenny of Kansas City, Mo., [illegible] from a $150 a month [illegible] at $800 a month. One month he made $840.

$4500 a Year

M. V. Stephens of Albany, Ky., was making $25 a week. He took up this training and now makes 5 times that much.

Small Pay to Big Earnings

J. H. Cash of Atlanta, Ga., exchanged [illegible] for a [illegible] which pays him $500 a month.

It has always been my personal belief that it is better to do one thing WELL than to do several things in a mediocre fashion. For this reason myself and my associates have never attempted to teach other subjects. Salesmanship is a never-ending study—and in over eighteen years the Association has never let up in its search for new ideas.

Not a "One Man" Institute

No one man has been responsible for the N. S. T. A. System of Salesmanship Training. No matter how brainy or successful one man may be his viewpoints and ideas must necessarily be prejudiced and limited.

Thousands of master minds in selling have contributed to the N. S. T. A. text—and will continue to contribute to it. Many leading sales authorities are ACTIVELY identified with the association at the present time—each man a sales executive with a nationally known company.

Is it any wonder that our Members make good right from the start when the proved plans, wisdom and experience of hundreds of sales authorities are laid before them?

How the N. S. T. A. Originated

Twenty years ago when I was Sales Manager for a nationally known firm that employed hundreds of salesmen, I found that my sales letters and bulletins helped my men to increase their sales. In one year, as a result of weekly letters and bulletins to the man in the field we increased our business 132%. Is it any wonder that I conceived the idea of teaching salesmanship by mail?

With the assistance of a few able friends in the profession the Association was formally launched in 1907. Today it is the largest and oldest Institution in the world specializing in Salesmanship Training.

No institution can guarantee a man success. But the N. S. T. A. can guarantee to give any man the finest training in salesmanship in the world. It can guarantee that no other institution can produce the same evidence of merit or offer as much for the nominal tuition fee.

Furthermore, the N. S. T. A. has an iron-clad MONEY BACK GUARANTEE as tangible evidence of merit.

Why Dodge Better Pay?

If thousands have succeeded in a big way as a result of N. S. T. A. Training—most of them, men who had never sold a dollar's worth of goods in their lives before enrolling—is there any reason why YOU should not succeed in the greatest of all professions—salesmanship?

No man is more important in business than the salesman. He is paid the best because he is the MOTIVE POWER back of any business. And you can quickly and easily learn the secrets that make Master Salesmen. Inside twenty weeks you can start out as a city or traveling salesman fortified with the knowledge that has enabled thousands of our Members to step from poor pay to big earnings.

This opportunity is before you NOW—backed by a Money Back Guarantee. Are you going to be a wage slave this time next year when there are thousands of openings waiting for men who KNOW HOW TO SELL.

With My Compliments—An Amazing Book

It will not obligate you to fill in and mail the coupon below. And you owe it to yourself. I want you to get the facts—then decide for yourself. The book, "Modern Salesmanship," will prove a revelation to you. Let me send it to you. You certainly ought to read it if you want to make more money. And who doesn't?

NATIONAL SALESMEN'S TRAINING ASSOCIATION
Dept. A-15
N. S. T. A. Building, Chicago, Ill.

EMPLOYERS **are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group plan of instruction for entire sales forces. Synopsis and charts sent without obligation.**

NATIONAL SALESMEN'S TRAINING ASSOCIATION
World's Oldest and Largest Exclusive Sales Training Institution
Dept. A-15 — N. S. T. A. Building
Chicago, Ill.

National Salesmen's Training Association,
Dept. A-15 N. S. T. A. Bldg., Chicago, Ill.
Send me FREE your book "Modern Salesmanship," and proof that I can become a Master Salesman.

Name
Address
City — State
Age — Occupation

Prize Winning Letter in the November Contest

Five members of the World Opportunities' Society will receive scholarships in the Coyne Electrical School as a result of Mr. Calder seeing this school's advertisement in the columns of POPULAR SCIENCE MONTHLY. Here is Mr. Calder's letter which wins the first prize of $50.00 in the November Contest:—

DEAR SIR

The advertisement of Coyne Electrical School in the Money Making Opportunities' Department caught my interest because it offers a permanent and progressive opportunity—a well paid profession of constructive service.

I decided to investigate their offer. I called at the school and found it an institution of such merit that I was most favorably impressed.

This I reported to the Committee on Scholarship of our Fraternal Order. Upon deliberation the Committee decided to offer five annual scholarships in the Coyne School for our members.

See what that one advertisement accomplished!

Yours truly,

M. CALDER.

World Opportunities' Society, Chicago, Illinois.

Complete List of Prize Winners In the November Contest

FIRST PRIZE $50

M Calder, Chicago, Ill.
(Coyne Electrical School)

SECOND PRIZE $25

Russell J. Landeen, Forest Lake, Minn.
(Niagara School of Music)
(American School of Aviation)

THIRD PRIZE $10

Peter Hersig, Hawleyville, Conn.
(Theo Audel & Co.)

PRIZE WINNERS who received $1.00 each for their letters—

Leland Perry Cedar City, Utah.
(Chicago Engineering Works)

William F Sandmann, Ft. Wayne, Ind.
(Victor J. Evans & Co.)

Frank S Cerny Chicago Ill.
(American Correspondence School)

Arthur W Zabel, Eagle Rock Calif.
(International Correspondence School)

M H Johnson, Omaha, Nebr.
(Allied Marbe Institute, Inc.)

Harold F Reed, Niagara Falls, N. Y
(Victoria Stamp Co.)

J N Lawrence Marc Island, Calif.
(Publisher Publishing Co.)

Elga Sauer Denver Colo.
(The Weldon Fire Gun)

Lyman Michaels, Bristol, Conn.
(Theo Audel & Co.)

Harry B Stillman, Plainville Conn.
(International Correspondence School)

Elmer Evans, Springfield, Ohio.
(International Studios)

Leon C Merryfield Bucyrus, Ohio
(Northwestern School of Taxidermy)

A. S. Bailey Houston, Texas
(National Salesmen's Training Assocn Inc)

Charles M Reynolds, Spruce Creek, Pa.
(Chicago Engineering Works)

Clarence H. Christopherson, Delavan, Minn.
(Coyne Electrical School)

Quick Action Advertising

ADDING MACHINES

FREE trial, marvelous new adding machine, adds, subtracts, multiplies, divides automatically. [illegible] Lightning Calculator Co., Dept. [illegible], Grand Rapids, Michigan.

ADVERTISING SERVICES

[illegible]

[illegible] Three, Scientific Advertiser, [illegible], Mich.

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. [illegible] Popular Science Monthly [illegible] Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

[illegible] in all magazines and newspapers [illegible] free. [illegible] Advertising Service, Dept. [illegible]

[illegible] display, [illegible] Smith's Service, Wenatchee, Wash.

ADVERTISE in 24 big [illegible] Newspapers. 24 words [illegible]. Specializing in [illegible] and Newspaper advertising [illegible]. Lists and consultation free. [illegible]

AUTHORS AND MANUSCRIPTS

[illegible]

WRITERS—[illegible]

[illegible] Photoplay [illegible]

[illegible]

I WANT [illegible]

AUTOMOBILES AND ACCESSORIES

DELIVERY bodies for Ford Model T Chassis with inclosed cab, suitable for Contractors, Grocerymen and Farmers. Three styles. Price $37.50. Write Daniel Zimmerman, Craigville, Indiana.

[illegible]

CARBON & [illegible]

AVIATION

[illegible]

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." [illegible] Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

[illegible] Crawford Aeroplane [illegible]

[illegible]

BOYS get a three foot model aeroplane free. Write to Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

BOATS AND LAUNCHES

[illegible]

BOOK PRESSES

[illegible]

[illegible] Popular Science Monthly, 250 Fourth Avenue, New York, N. Y.

BRANCH OFFICE SERVICE

WASHINGTON mail address [illegible]. Established 1920. Address "Service", 606 District National Bank Building, Washington, D. C.

Rate 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the Mar. 1926 issue should be received by Jan. 5th.

BUSINESS OPPORTUNITIES

[illegible]

[illegible] Washington, D. C. [illegible]

[illegible]

[illegible] Watterson Bureau [illegible]

[illegible] Catalog free. [illegible]

[illegible] Big saving. [illegible] (Courses bought.) [illegible]

[illegible] Starion, Indiana.

LEARN the collection business. Good income; quick [illegible]

[illegible]

STOP plodding! Be successful. Operate a tire repair shop. [illegible] Haywood's, 1308 South Oakley Avenue, [illegible]

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." [illegible] Popular Science Monthly, 250 Fourth Avenue, New York.

[illegible]

[illegible]

[illegible]

[illegible] Write Dept. [illegible], 1133 Broadway, New York.

[illegible]

[illegible] See our advertisement on page [illegible]. The Electro Thermal Company, [illegible] Ohio.

[illegible]

[illegible] mail order business. [illegible]

[illegible]

$50 WEEKLY. Your Own Business. Enormous Profits. Plan, Sample 50c. [illegible] 1126 Street, Richmond Hill, N. Y.

[illegible]

BUSINESS SERVICE

[illegible]

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. [illegible] Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

CHALK TALKS

[illegible] Circulars free. [illegible]

DISTRICT MANAGERS AND REPRESENTATIVES WANTED

[illegible]

DOGS

[illegible] Bulldogs, [illegible]

EDUCATION AND INSTRUCTION

[illegible] San Francisco.

[illegible] Used courses bought. [illegible] Exchange, Dept. A, 47 West 42d Street, New York.

[illegible]

[illegible] Write Carnegie [illegible]

[illegible] Courses bought and sold. [illegible]

[illegible]

[illegible] Copyright book free. [illegible]

[illegible]

FOR BOYS

[illegible]

FORD ACCESSORIES

[illegible]

[illegible]

FOR INVENTORS

[illegible]

UNPATENTED ideas can be sold. I tell you how and help you make the sale. Free particulars. [illegible] Write W. T. Greene, 808 Jenifer Building, Washington, D. C.

FREE. Patents. Established in 1890. Charles A. Scott, [illegible] Avenue, Rochester, New York.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

CASH [illegible] for your patent or invention under our new plan. Write at once to Inventors' Syndicate, [illegible], St. Louis, Missouri.

PATENTS. [illegible] Free personal advice. Frank T. Fuller, Washington, D. C.

[illegible] Instructions, legal blanks, $1. [illegible]

SELL your patented or unpatented invention. Write for my three plans. Free. Hartley, 44 Central St., Bangor, Maine.

[illegible] Progressive Association, [illegible]

FOR MEN AND WOMEN

[illegible] Work home or travel. Experience unnecessary. [illegible] Wagner, former Government [illegible], N. Y.

[illegible] See our advertisement on page [illegible]. The Electro Thermal Company, [illegible] Ohio.

[illegible] EXPERT PENMAN [illegible]

FORMULAS

[illegible] Laboratory Formula [illegible]

FOR SALE

[illegible] bargain. [illegible]

[illegible] miniature [illegible]

MR. MANUFACTURER [illegible] Ford [illegible] wagons, [illegible] ditching. [illegible] Markham, Applegate [illegible]

Money Talks!

About 100,000 people have tried this remarkable hair-growing method. Each had the privilege of getting his money back. Yet when the 30-day trial period expired only 3 out of every 100 asked for a refund. And they got it instantly!

The same square guarantee is open to you. No strings—no loopholes—no alibis no "ifs" or "buts" or "maybes" if my new method doesn't grow new hair for you in 30 days—I'll send you my check refunding every penny you have paid and the trial will have cost you absolutely NOTHING!

I Guarantee YOU New Hair In 30 Days—*Or I Pay All Costs!*

By Alois Merke
Founder of Famous Merke Institute
Fifth Avenue, New York

GRASP this chance. Start now and save yourself from the tragedy of baldness. Let me prove to you—without a cent of risk—that you can grow new hair in 30 days!

An Amazing Contract

No matter how fast your hair is falling out—no matter how little of it is now left—no matter how many treatments you have tried without results,—I absolutely guarantee that my new method will give you new hair in 30 days or the trial costs you nothing.

Why I Make It

I have found during many years research and from experience gained in treating thousands of cases of baldness at the Merke Institute, Fifth Avenue, N. Y., that in most cases of loss of hair the roots are not dead but merely *dormant*

It is useless and a waste of time and money to try and get down to these under-nourished roots with the average tonic or with massages, crude oil, etc., for such measures only treat the *surface* of the skin

My Method Gets To the ROOTS

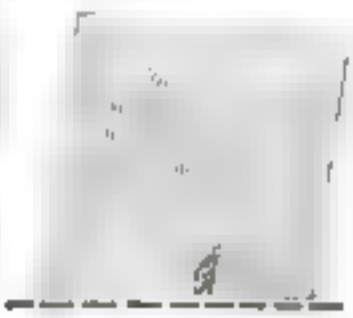
But my scientific system involves the application of entirely new principles in stimulating hair growth. It penetrates below the surface of the scalp and gets right to the cause of most hair troubles—the starving, dormant roots. It provides not only an efficient way of reviving and invigorating these inactive roots but of giving them the nourishment they need to grow hair again. And the fine thing about my system is the fact that it is simple and can be used in any home where there is electricity without the slightest *discomfort or inconvenience.*

No Cost If It Fails

Of course there are a few cases of baldness that nothing in the world can help. Yet so many hundreds of men and women whose hair was coming out almost by "handfuls" have seen their hair grow in again as the sunken roots acquire new life and vitality that I am willing to let you try my treatment at my risk for 30 days. Then if you are not more than delighted with the new growth of hair produced, write me immediately. Tell me my system has not done what I said it would, and the 30-day trial won't cost you a cent.

Free Booklet Tells All

The very fact that you have read this announcement shows that you are anxious about the condition of your hair. So why not investigate? Find out for yourself. If you will merely fill in and mail the coupon I will gladly send you without cost or obligation a wonderful, interesting booklet which describes in detail my successful system which is growing new hair for thousands all over the country. In addition it tells all about my iron-clad guarantee which enables you to take my treatment without a penny's risk. Clip and mail the coupon today. Allied Merke Institutes, Inc., Dept. 171, 512 Fifth Avenue, New York City.



Allied Merke Institutes, Inc.
Dept. 171, 512 Fifth Avenue, New York City

Please send me without cost or obligation a copy of your book, "The New Way to Grow Hair" describing the Merke System

Name

Address

City State

RESULTS

Results Gratifying

"Ten years ago my hair started falling. I used hair [illegible] constantly but four years ago I acquired a perfect air waves. I tried everything but without results. Today, however, thanks to your treatment I have quite a new crop of hair growing." F. H. B., New York.

Hair About Gone

"My hair has been falling for the last ten years and I had hardly any more hair on the front of my head. But since I started using your treatment I am raising a new crop of hair. Your treatment is best I ever saw."—G. J., Northbridge, Mass.

New Hair Growing

"Results are wonderful. My hair has stopped falling out and I can see lots of new hair coming in." F. D. R., Washington, D. C.

New Hair on Bald Spots

"I have used Thermocap Treatment for 8 weeks and although the top of my head has been entirely bald for 6 years the results up to the present are gratifying. In fact the entire bald spot is covered with a fine growth of hair." W. C., Kenmore, Ohio.

Can't Say Enough For It!

"Am glad to say I can see such great change in my hair. It is growing longer and my head is full of young hair that has made its way through since I have been using Merke Thermocap. I can't say enough for it. It will do everything you claim it to do." A. G., Texas.

FOR THE HOME

BIG money in weaving Colonial rugs, quaint rag carpets, scarfs, etc. Home weavers are always busy. Looms now as low as $9.90. Liberal Pay-As-You-Weave terms. Write today for free Loom Book. Union Loom Works, 462 Factory St., Boonville, N. Y.

GRANDFATHER clock works $[illegible]. Build your own case, instructions free, make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. [illegible] Co., [illegible] Free.

TO the man who likes to work with tools: Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1 Sewing Table, No. 3 [illegible] Cabinet, No. 12 Tea Wagon, No. [illegible] Workshop Bench, No. 17 Cedar and Mahogany Chest, No. [illegible] Tube Radio Set, No. 42 Radio Receiver with three stages of amplification, No. 43 Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 250 Fourth Avenue, New York, N. Y.

HELP WANTED

SILVERING Mirrors. French plate. Easily learned; immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

MR. BRUSH Salesman: Old Established New York Brush Manufacturer requires the services of men in all territories to sell their exclusive line of Sanitary Twisted in Wire Brushes. We pay larger commissions than any other Brush House in the country. Write immediately for our proposition. Wire Grip Sanitary Brush Corp., 15 Mercer St., New York.

MEN wishing to enter dining car, sleeping car service as conductors, porters, waiters, write 1[illegible] Railway Exchange, Kansas City.

WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

EARN $10 to $20 weekly mailing circulars at home. Outfit and instructions, 10c coin. [illegible] 4[illegible], Arlington, Alabama.

HELP WANTED INSTRUCTION

U. S. GOVERNMENT Jobs. Railway Mail Clerks. Mail Carriers. $[illegible] year. [illegible] Men [illegible] Sample coaching [illegible]. Write immediately. Franklin Institute, Dept. [illegible], Rochester, N. Y.

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

FIREMEN, Brakemen, Baggagemen, Sleeping car, train porters (colored), $140-$200. Experience unnecessary. 838 Railway Bureau, East St. Louis, Ill.

HOW TO ENTERTAIN

PLAYS, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogs, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 36, Chicago.

INCORPORATIONS

INCORPORATE Delaware. [illegible] Market St., Wilmington, Del. (Established 1909.)

DELAWARE Incorporation. Charters. Fees Small. Forms [illegible] G. Cuyler Co., Orange St., Wilmington, Delaware.

INFORMATION

$[illegible] worth information circular [illegible]. Lakeside Bureau, 30 Lake [illegible], Mass.

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know wouldn't you? Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

INSECTS WANTED

WHY not spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth $1 to $7 each. Simple outdoor work with my instructions, pictures, price list. Send 10 cents (not stamps) for my Illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Box 1424, Dept. 7, San Diego, California.

INVENTIONS FOR SALE

TWO inventions for sale on woodworking tool. John Baker, 2 [illegible] Central Place, [illegible] Island, N. Y.

LABORATORY AND CHEMICAL SERVICES

GUARANTEED Reliable Formulas. Trade Secrets, Rare, Dependable Manufacturing Processes for all lines, detailed working directions, inside commercial information. Don't buy till I've sent you my valuable literature. Lists. Satisfaction Guaranteed. [illegible] Miller, Formulist, Chemist, [illegible], Florida.

ADVICE from engineers will save you from making costly mistakes in buying radio and tool equipment. Write to Popular Science Institute, 250 Fourth Ave., New York City, for list of tested and approved products. See page 6.

YOUR chemical problem solved and working process furnished for $5.00. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

MELT metals, nickel, brass, gold and other alloys. Electric melting furnaces priced from $[illegible]. [illegible] Best Electric Furnaces, 4[illegible] N. [illegible] St., Chicago, Ill.

LANGUAGES

WORLD-ROMIC System, Masterkey All Languages, Primers $1.00: Chinese, French, Spanish. Languages, 8 West 40th, New York.

LETTER SPECIALISTS

I WRITE letters, folders, booklets, complete follow-up for manufacturers, mail order dealers. Long experience. Write for details. L. Taylor, Box 544, Freeport, Ill.

LISTS

NAMES, postcards, cuts. Ben Meier, 35 West 21st St., New York.

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MACHINE TOOLS

No. 50 HEALD Auto Cylinder Grinder $750.00; No. 2 Cincinnati Milling machine $[illegible]; 24" Hendey Shaper $[illegible]; [illegible] Bradford Engine Lathe $[illegible]; [illegible] 20" Drill Press $[illegible]; 24" Woodworker Planer $[illegible]; 36" Band Saw $[illegible]. Terms. Figure on single machine or complete shop. A complete line of machinery and supplies. The Eben Machinery & Supply Co., 316 E. Pearl St., Cincinnati, Ohio.

MAGIC TRICKS

BE a magician, give shows, earn money. Catalogue 10 cents. Oaks Magical Co., Dept. [illegible], Oshkosh, Wis.

MAGIC goods, novelties, [illegible]. [illegible] Catalog free. [illegible] Fenner, 2401 Jefferson, [illegible].

MAIL ORDER BUSINESS

$[illegible] extra a year. Home evenings. I made it. Mail Order Business. Advertising booklet for stamp explains. Sample and plan 25c. [illegible], N. Y.

MONEY making ideas. Mail order supply sources. 10c. [illegible] Englewood, N. J.

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MANUFACTURING

DEVELOPING ideas and manufacturing our specialty. Aluminum metals, [illegible]. 27 years experience. Write us. The K. & B. Die & Specialty Co., 2018 Elm St., Cincinnati, Ohio, Dept. [illegible].

ADVICE from engineers will save you from making costly mistakes in buying radio and tool equipment. Write to Popular Science Institute, 250 Fourth Ave., New York City, for list of tested and approved products. See page 6.

WANTED: light manufacturing and experimental work. Prices guaranteed to be cheapest in America. Send models or drawings for quotations. Metal Mfg. Co., Station A, New Haven, Conn.

MANUFACTURING. Models, Dies, Stamping, Brass Work. One or thousands. Mason's Metal Specialists, [illegible].

MISCELLANEOUS

[illegible] Trade [illegible], Animals [illegible]. [illegible] St., Brooklyn, N.Y.

WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

MINERAL Treasure under foot. [illegible] Information 10c. Sixteen identified $1.00. Mineral specimens. [illegible], Mo.

MODELS AND MODEL SUPPLIES

BUILT [illegible] Chicago. All [illegible] makers, Machinists, Model Makers, Tool Patterns. Complete general Machine shop. [illegible]

WE make working models for inventors and experimental work and offer a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

MODEL [illegible] steam engines [illegible] fittings. Marine [illegible]. Send 25c for this year's illustrated catalogue handbook. [illegible] Mfg. Co., Dept. C, [illegible], Pa.

MOTORCYCLES, BICYCLES, SUPPLIES

[illegible] Used Motorcycles [illegible] Indian Chief [illegible] Harley-Davidson [illegible] Henderson Deluxe [illegible]. Two hundred others, write for free list. Mayhew Brothers Co., [illegible] Berkeley St., Boston, Mass.

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

MOTORS, ENGINES AND MACHINERY

GUARANTEED [illegible] H.P. [illegible] 60 cycle single phase used motors with pulley $[illegible] each. Also brand new [illegible] H.P. [illegible] make at $[illegible] each. Brand new [illegible] speed light and power generators at $[illegible] each. [illegible] F.O.B. We have special prices on 32 volt motors. We repair and rewind electric motors and generators, etc. Bargains on electric fans. General Distributing Co., [illegible] Bldg., [illegible].

MUSICAL

SAXOPHONISTS, Clarinetists, Cornetists, Trombonists. Get "Free Pointers." Virtuoso Music School, [illegible], N. Y.

OPTICAL GOODS

ARTIFICIAL eyes. Booklet free. Denver Optic, 108 Barclay, Denver, Colorado.

OFFICE DEVICES

[illegible] folders, [illegible] half new cost. [illegible] St., Chicago.

PATENT ATTORNEYS

PATENTS: Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for FREE book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 563 Security Bank Building, directly across street from Patent Office, Washington, D. C. See page 99.

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PATENT ATTORNEYS

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HUBERT E. PENNER, patent attorney and mechanical expert. [illegible] F Street, Washington, D. C. I report if patentable, usable and [illegible]. Send for circular.

PATENTS. My fee in installments. Free personal advice. Frank T. Fuller, Washington, D. C.

MUNN & CO., [illegible] Bldg., Washington, D. C. Patent [illegible] Since 1845. [illegible] Booklet and Priority Record Blank gratis.

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PATENTS FOR SALE

[illegible] Patents [illegible] Table. Two complete [illegible] Illustrated [illegible] for a Prospect. A fortune can be made from this invention. [illegible], [illegible] York, [illegible].

PHOTOGRAPHY AND SUPPLIES

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 127 Camera House, Boston, 17, Massachusetts.

LEARN Photography at home as a photographic expert; make $75 a week while learning; professional camera furnished free; write quick for full information. International Studios, Dept. 1742, 3601 Michigan Ave., Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

PHOTOGRAPHS made from Sketches of Ideas. Photos for printers. [illegible], 740 [illegible], [illegible].

ENLARGEMENTS [illegible] Trial Offer. Your Kodak film developed and printed only [illegible] R. H. B. Photographers, Dept. [illegible], 1240 Lincoln Ave., Cincinnati, Ohio.

PRINTING AND ENGRAVING

1,000 Letterheads, Envelopes, Cards $[illegible] postpaid. [illegible] Samples free. Arbor Press, 60 Houghton, Worcester, Mass.

[illegible] Printing [illegible] 20 lb. Hammermill Bond Letter Heads [illegible] $[illegible], white [illegible] envelopes, one thousand, $2.25. The Courier Company, [illegible].

MONEY making business forms sent free. [illegible] Schenectady, N. Y.

200 Engraved [illegible] $1.00. Commercial size for business use. Name, business and address. Prompt service. [illegible] of 10 Big Dollar Specials Free. F. H. Kendall, Elmira, N. Y.

BETTER Printing for Less Money. Write us about your printing needs and you will save money. Ernest [illegible] Company, 5[illegible] South Dearborn Street, Chicago.

EARN $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 1[illegible], St. Louis, Mo.

RAZORS AND BLADES

1,000 SHAVES from one razor blade. Secret 25c. Butler, Box 1278, San Francisco.

SALESMEN AND AGENTS WANTED

AGENTS: Make a dollar an hour. Sell Mendets, a patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

[illegible] silvering mirrors, plating and refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. [illegible] Laboratories, 1133 Broadway, New York.

AGENTS: Write for free samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. [illegible] weekly and bonus. Madison Mfgrs., 505 Broadway, New York.

[illegible] Carnation Co., Dept. [illegible], St. Louis.

AGENTS: [illegible] every [illegible] black ink. Every office [illegible] demand [illegible] everywhere. [illegible] Sample free. H. Mara Company, Tribune Building, New York.

[illegible] Weld. Repairs large punctures without cement or heat. Large profit [illegible]. Write quick. Free sample. Territory going fast. [illegible] Mfg. Co., Dept. 8, Minneapolis, Minnesota.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

AGENTS: [illegible] we manufacture and [illegible] new household [illegible]

WE pay $48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

[illegible] free [illegible] La Derma Co., Dept. [illegible]

AGENTS: Big profits. [illegible] Company, [illegible] Avenue, New York.

[illegible]

WANTED: [illegible] Chicago.

[illegible] Robert H. Ingersoll, [illegible] Broadway, New York, N. Y.

WOW! [illegible] the Ferrari Automatic [illegible] Ferris Razors Co., 2814 Enright Ave., St. Louis, Mo.

[illegible] Free sample. L. [illegible], Dept. B, [illegible] Chicago.

[illegible]

[illegible] demonstration [illegible] Free sample offer. Mallard Chem. Co., [illegible] St. Louis, Mo.

AGENTS: $60 – $200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441-A N. Clark, Chicago.

[illegible] plan for monogramming automobiles, trucks, hand luggage and all [illegible] Monogram Accessories [illegible] Mansfield, Ohio.

POLMET POLISHING [illegible] cleans all metals. Sells fast at 25c. Sample free. F. C. Gale Co., 15 Edinboro St., Boston.

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$10 DAILY [illegible] Write Consolidated [illegible]

AGENTS: [illegible] Amazon Building, Philadelphia.

[illegible] Particulars free. W. P. [illegible] N. Y.

[illegible] Write at once. [illegible] Chicago.

BANKRUPT and Rummage Sales. Make $50.00 daily. We start you, furnishing everything. Distributors, Dept. 34, 609 Division, Chicago.

AGENTS: Steady income. Large manufacturer of [illegible] Freeport Mfg. Co., 40 Main St., Brooklyn, N. Y.

[illegible] business of your own. Make and sell chipped glass name and house number plates [illegible]

[illegible]

WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

AGENTS: [illegible]

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." [illegible] Popular Science Monthly, 250 Fourth Ave., New York.

[illegible] Federal Pure Food Co., [illegible] Archer, Chicago.

[illegible] National Scientific Laboratories, [illegible] Broad, Richmond, Va.

[illegible]

[illegible] Lightning Co., St. Paul, Minn.

[illegible]

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." [illegible] Popular Science Monthly, 250 Fourth Ave., New York.

[illegible] Make them yourself [illegible] Washington, D. C.

WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

[illegible] genuine French Lingerie [illegible]

[illegible]

[illegible] American Products Co., [illegible] Cincinnati, Ohio.

[illegible] Indianapolis, Ind.

WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

[illegible] Agents wanted. [illegible]

[illegible]

[illegible] Agency, [illegible] 261 Broadway, New York.

[illegible] Newark, N. J.

[illegible] Publishing Co. [illegible]

[illegible]

[illegible] Philadelphia.

[illegible] New York.

[illegible] New York.

[illegible]

[illegible]

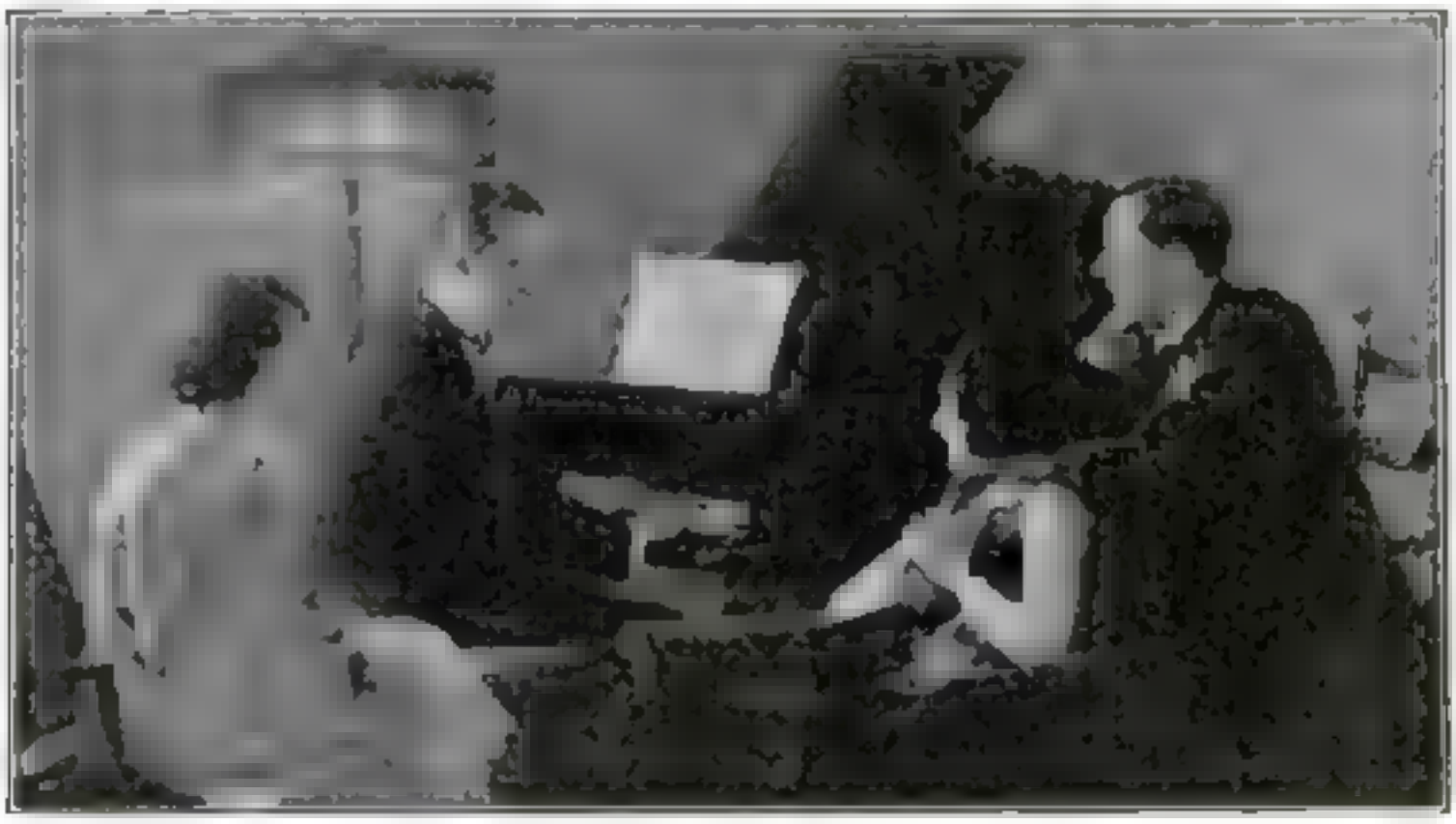
[illegible] Shirt Company [illegible]

[illegible]

[illegible] New York.

MR. ADVERTISER: Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some very important facts which will prove interesting and valuable to you. It also tells How You Can Use Popular Science Monthly Profitably. You'd like to know, wouldn't you? Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

They Thought I Was Bluffing



—When I Told Them I Learned Music Without a Teacher

You could have heard a pin drop in the room! I had just finished playing Rubinstein's "Melody in F." My friends were actually dumbfounded—they couldn't believe their ears. At last I was the *center of attraction* instead of a mere *onlooker!* It was just like a dream come true!

"Why, you didn't know a single thing about music not so long ago, Bob"—"How in the world did you ever do it?" A note of half envy, half admiration unconsciously crept into their voices after they had recovered from the unexpected surprise which I had just furnished. "Yes," said Jim, "what sort of a trick have you played on us—I thought you weren't musically inclined?" "Oh, he's been taking lessons for years and has kept it a secret"—followed Betty and Sue in rapid-fire succession. "You can't fool us though, you never learned to play that well without a teacher."

"Well, you're all wrong—every one of you," I replied, chuckling with glee. "I'll admit that a short time ago I didn't know one note of music from another. And as far as special talent goes—well, I never had any. And although I had always longed to be able to play the piano it was more or less of an empty dream. For I just couldn't stand the thought of learning music from a teacher and going through a lot of monotonous scales and exercises. It just went against my grain.

"So I've just contented myself with sitting around envying others who could play—watching them have all the fun. Until one night last March I was reading a popular magazine and suddenly an announcement caught my eye. It told of a new easy method of quickly learning music right in your own home—and without a teacher. At first I laughed like you folks, I thought that such a thing was a joke. Somehow or other I didn't believe it was possible to learn music by mail. But that announcement set me wondering. So I decided that the only sensible thing to do was to investigate. And—well, you know the rest.

* * * * * *

From the very beginning I was enthusiastic about my wonderful course in music. Each new lesson was better and easier than the last. Everything about them was so simple that a child of eight could understand it. It was great fun—actually as fascinating as learning a new game. And I always played real notes and catchy tunes. No tricks, puzzles or makeshifts of any kind.

Now I can play any piece of music whether it's a ballad, jazz or classical number. And I never have to refuse when I'm called upon to entertain. No more lonely nights for me. Now my life is just a joyous round of gay parties and admiring friends.

* * * * *

Pick Your Instrument

Piano	'Cello
Organ	Cornet
Violin	Harmony and Composition
Drums and Traps	Sight Singing
Banjo	Ukulele
Tenor Banjo	Guitar
Saxophone	Hawaiian Steel Guitar
Mandolin	Piccolo
Clarinet	Harp
Flute	Trombone

Voice and Speech Culture
Automatic Finger Control
Piano Accordion

Play Any Instrument

You, too, can now teach yourself to be an accomplished musician right at home in half the usual time through this startling method which has already shown 150,000 people how to play their favorite instrument. Forget that old-fashioned idea that you need special "talent." Just read the list of instruments in the panel, decide which one you want to play and the U. S. School will do the rest. And bear in mind no matter which instrument you choose, the cost in each case will be the same—just a few cents a day.

No matter whether you are a mere beginner or already a good performer you will be interested in learning about this new and wonderful method.

Send for Our Free Booklet And Demonstration Lesson

In order to make it clear to you—to show you just how and why it gets results twice as fast as any old-time method—we will send to you upon request an interesting free booklet and a valuable demonstration lesson that will make clear the method by which so many thousands have learned. The method is the same for all instruments.

If you are in earnest about wanting to play your favorite instrument—if you really do want to gain the proficiency in music that will add to your happiness, increase your popularity and open the way to greater income—send at once for the free booklet and demonstration lesson. Getting them will cost you nothing and place you under no obligation. Right now we are making a Special Offer to a limited number of new students.

Now—before it's too late to gain the benefits—sign and mail the convenient coupon. Instruments supplied when needed, cash or credit. U. S. School of Music, 81 Brunswick Bldg., New York City.

U. S. SCHOOL OF MUSIC,
81 Brunswick Bldg., New York City.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, Demonstration Lesson and particulars of your Special Offer. I am interested in the following course

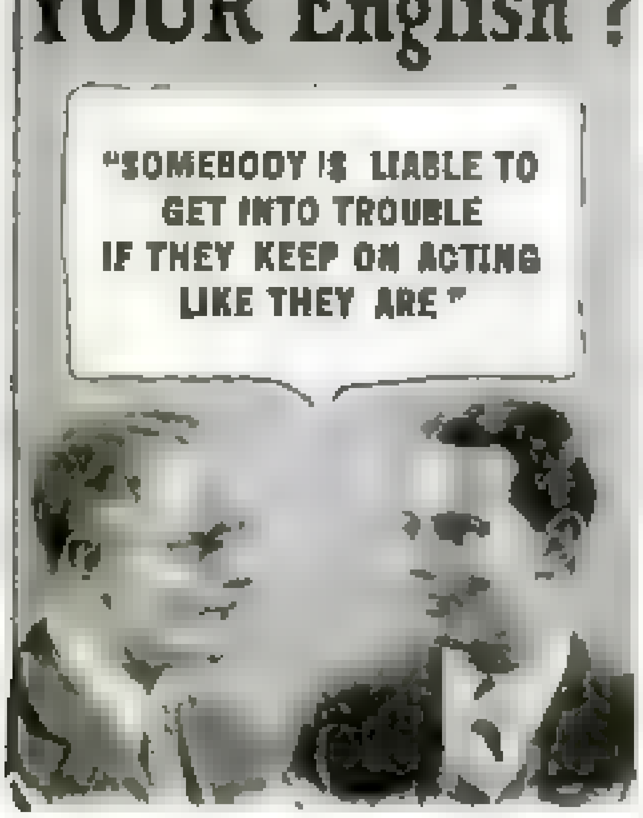
Have you above instrument?

Name
(Please write plainly)

Address

City ..... State .....

What's Wrong With YOUR English?



Stop Making Mistakes

They may offend others as much as these offend you

If some one you met for the first time made the mistakes in English shown above, what would you think of him? Would he inspire your respect? Would you be inclined to make a friend of him? Would you care to introduce him to others as a close friend of yours?

These errors are easy for you to see. Perhaps, however, you make other mistakes which offend other people as much as these would offend you. How do you know that you do not make some certain mistakes? Are you always sure that the things you say and write are grammatically perfect? To you they may seem correct, but others may know they are wrong.

Unfortunately, people will not correct you when you make mistakes; all they do is to make a mental reservation about you. "He is ignorant and uncultured," they think. So you really have no way of telling when your English offends others.

FREE Book on English and 15-Minute Test

Sherwin Cody, perhaps the foremost teacher of English in the country, has prepared a simple 15-minute English test which you can take in your own home. This test, with the answers which will also be sent, tells you at once just where you stand. You can discover at a glance whether you make even slight errors. Give yourself this test. If you are efficient in English, it will give you greater confidence; if you are deficient, you surely want to know it, so that you can correct your mistakes.

Mr. Cody's remarkable new invention, the 100% Self-Correcting Method, has already improved the English of more than 41,000 people. No useless rules, no tedious copying, no hard study. Only 15 minutes a day required. You learn by creating the HABIT of using correct English. Nothing like Mr. Cody's method has ever been used before.

You do not want others to judge you unfairly. Write today for this test—it is free. We will also gladly mail you our new free book, "How to Speak and Write Masterly English." Merely mail the coupon or a postal card.

Sherwin Cody School of English
181 Searle Building Rochester, N. Y.

Sherwin Cody School of English
181 Searle Building, Rochester, N. Y.

Please send me your Free Book, "How to Speak and Write Masterly English," and also Mr. Cody's 15-minute Test in English.

Name..

Address..

City.............................State..........

SALESMEN AND AGENTS WANTED

MAKE (the Bureau) in spare time—sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, Inc. 125-A Austin Ave., Chicago.

SALESMEN: Earn $72 to $100 weekly [illegible] ALL WOOL made-to-measure suits $23.50 [illegible] $4 to [illegible] profit on every sale. Six day delivery. United States Delivery and Guarantee Bond of satisfaction or money refunded. Experience unnecessary. Write today for large free spring samples. Homeland Tailoring Co., Inc., 1 to 3 W. Lake [illegible] Dept. [illegible] Baltimore, Md. [illegible]

SELF THREADING [illegible] See [illegible] every issue. Fine side line, easily carried, big profits, sample free. [illegible] Brothers, 47 East 25th St., New York.

AGENTS: Full or spare time to sell hand painted [illegible] pillows. [illegible] A wonderful new process. Our agents are cleaning up. Photographs [illegible] sell themselves. Write for full particulars of [illegible] agency offer and circulars describing Photographs today. Bradford's Photographs, Inc., St. Joseph, Mich.

ARE you old at forty? See our advertisement on page 130 of this issue. The Electro Thermal Company, 4053 Main, Steubenville, Ohio.

AGENTS [illegible] Wonderful Vapor Humidifier [illegible] Show [illegible] Where [illegible]

AGENTS: [illegible] spectacles guaranteed to satisfy only $1.98. Pay daily. We deliver collect. Nearly everybody buys. $10.00—$25.00 daily easy. True-Fit [illegible] Co. [illegible] Chicago.

AGENTS make $100 week placing advertising [illegible] Lighters with glass front. Every dealer wants one. Write for free plan. Drake Mfg. Co., Dept. F, Milwaukee, Wis.

SALESMEN: We furnish you a new Ford car immediately and set you up in business. You own both car and business. No capital required. Profits $50 to $150 per week easy. Exclusive territory, city or country. Biggest opportunity ever offered hustlers. Territory going fast. Write quick for details. W. & H. Walker, Inc., Dept. 34, [illegible] Island, Pittsburgh, Pa.

ADVERTISING [illegible] Watch Charms with [illegible] enlarged 500 times, big seller. 3 samples and list [illegible] wholesale [illegible] 1210 [illegible] Ave., Bronx, New York.

STAMMERING

ST-STU-T-T-TERING and stammering cured at home. Instructive booklet free. Walter McDonnell, 80 [illegible] Avenue, Chicago, Ill.

STAMPS AND COINS

FREE: Price lists of 3,000 bargains and fine set [illegible] Penna Stamp Co. [illegible] Pa.

UNITED STATES and Foreign money. Medals. Catalogue and [illegible] 10c. Alexis Mengelle, Colorado Springs, Colorado.

[illegible] Approval applicants sending 2c. [illegible] Alameda, [illegible] Ohio.

STAMPS [illegible] all different, 3 cents. [illegible] free. F. H. [illegible] Stamp Co., Toledo, Ohio.

1,000 DIFFERENT stamps $2.00. Fred Onken, 630 79th Street, Brooklyn, N. Y.

OLD coins. Large Spring selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101D Tremont Street, Boston, Mass.

CALIFORNIA gold ¼ size, 27c; ½ size, 53c. While [illegible] and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS [illegible] 2c. Album (500 illustrations) 3c. [illegible]

UNITED STATES [illegible] Special issues, etc. 10c. [illegible] and 105 different, Foreign, [illegible] etc., 10c. [illegible] Parkview, St. Louis, Mo.

FREE [illegible] all different [illegible] approval applicants [illegible] Fresno, California.

[illegible] wanted in [illegible] big [illegible] Send 25c for fine selection. Calculator Co., Grand Rapids, Mich.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS, all makes, lowest prices, 5 year guarantee. Send for illustrated circular. Henry Typewriter Co., 217 West 1[illegible] Street, New York, N. Y.

WANTED

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

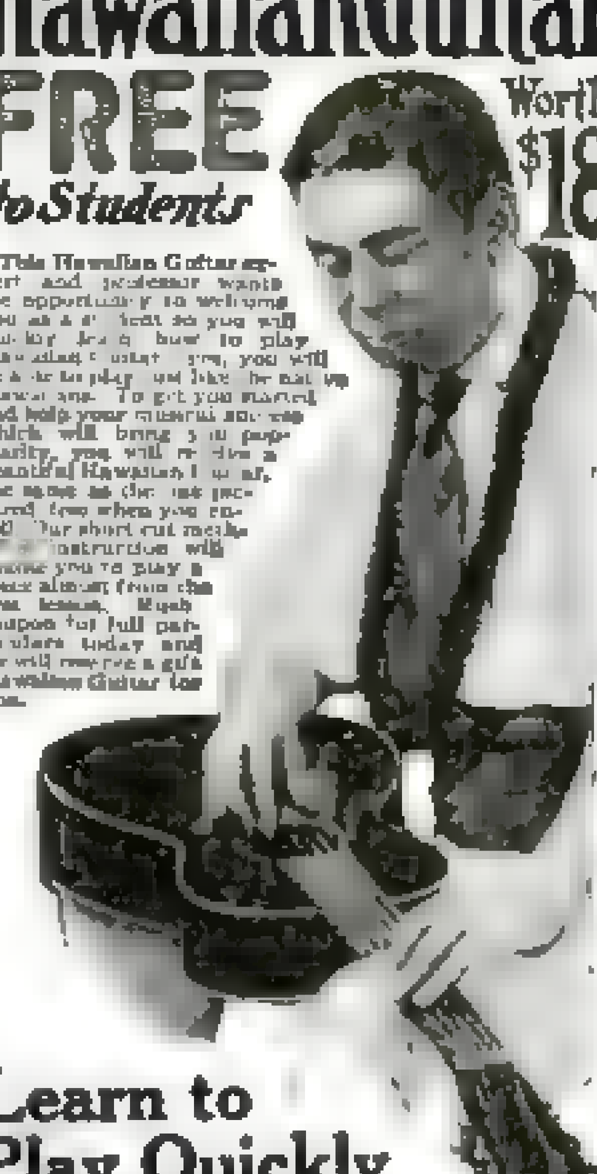
WANTED: Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

$100 in Cash Prizes

For the best letter of 150 words or less answering the question—"What advertisement in the "Money Making Opportunities" Section interests you most—and why? First read every advertisement in the "Money Making Opportunities" Section on pages 120 to 150. Pick out the one that interests you most and write a letter—not exceeding 150 words—telling us why you find the advertisement you have selected the most interesting.

See page 5 for last month's prize winning letters and additional information about this contest.

Hawaiian Guitar FREE to Students Worth $18



This Hawaiian Guitar expert and professor wants the opportunity to welcome you as a student so you will quickly learn how to play Hawaiian Guitar—yes, you will be able to play just like the native Hawaiians. To get you started and help your musical success which will bring you popularity, you will receive a beautiful Hawaiian Guitar, the same as the one pictured, free when you enroll. Our short cut method of instruction will enable you to play a piece almost from the first lesson. Rush coupon for full particulars today and we will reserve a gift Hawaiian Guitar for you.

Learn to Play Quickly

With our short cut method of instruction you will quickly learn to play Hawaiian Guitar which will bring you popularity and social success. You learn to play from notes. If you never had any musical training you will quickly get on, because our nine experts have perfected a course of home instruction which is as simple as learning A, B, C's.

Picture and Phonograph Record Method Easy

We don't depend upon printed lessons only for your success, but we furnish phonograph records [illegible] play-ing, diagrams, charts and photographs [illegible] for each lesson. This practically brings our professors from our studio to your own home and enables you to listen to their playing just as if they were actually in front of you. To prove this is easy we will send you your first lesson free.

Rush Coupon—Send No Money

So positive are we that you will become one of our students we will send free without obligation, our first lesson. Also receive our free big book which will explain particulars about our course. Write for your free book and your free lesson today.

HAWAIIAN STUDIO No. 141
of New York Academy of Music
100 Fifth Avenue, New York, N. Y.

Please rush your free book, "How to Learn Hawaiian Guitar," and my first lesson. Also reserve a gift Hawaiian Guitar for me. This obligates me in no way whatever.

Name..

Address..

City.............................State..........

FREE To Men Past 40

What is prostate gland disorder? Why does it come to 65% of all men past a certain middle age? Are you a victim? Why does it cause sciatica, aching feet, back and legs, frequent nightly risings? Amazing book written by a well known American Scientist answers all these questions and tells of a wonderful new method that has already given relief to more than 10,000 men—restored the prostate gland to its proper functioning without the use of drugs, electricity or lessons. For a limited time you can get a copy of this book free by simply writing a request to the **Electro Thermal Co., 4053 Main Street, Steubenville, Ohio**, the concern that is distributing this book for the author. No obligation, but write quick for the edition is limited. (Western office, Dept. 40-U, 711 Van Nuys Bldg., Los Angeles, Calif.)

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 15)

"Yes. It is rapidly becoming universal and replacing the old type lead battery."

"Which of your inventions are you completing or perfecting?"

"Phonograph, batteries."

Again we note the economical omission of "and."

Some one told me that the phonograph improvement relates to a method of automatic manufacture of the disks for records. And it is said the batteries are to be adapted for use with self starters for automobiles. Thus will be almost a revolutionary improvement. The alkaline storage cell lives forever compared with lead-sulphuric acid, but at present it lacks the immediate "kick" needed for a self starter.

"I WAS working on the battery to make it a self starter," said an old employee whom we may call Joe. "Told Mr Edison it wouldn't work. He came back at me pretty strong. 'Do you understand the theory of electricity, including its mathematics?' 'No, I don't,' said I. 'Only the practical part that I have to do with.' 'Well,' said he, 'you report a big voltage drop. Don't you know the amperes rise when the volts drop, so there is the same wattage? Don't you know that amperes multiplied by volts equal watts? So what's the trouble?'"

If I had been in Joe's place I should have wilted—taken my hat and slipped out of the laboratory as quietly as possible. Joe is a tough guy. He stood by what he knew. He dared remind the half-parent of electricity that wattage is not everything; voltage is pressure and is needed to do a job quick. There was too much internal resistance. More volts wanted. Thereupon Edison scratched his head—a good sign for Joe—and walked away.

I believe the moral of this story is not that Homer nods, but that we should stick to what we know until the cows come home.

To resume that interview, I asked, "On what new lines of research are you now engaged?"

"Many. Wait until I've caught the fish."

My guess is that the biggest fish is a new automobile battery that would last 10 years instead of two. The saving to America on that item would be more than a hundred million dollars a year. And the nickel-iron-alkaline battery gives out no explosive or injurious fumes.

"IF YOU were starting your career now, would you map a different course from that you have followed?"

"No," was the placid reply to an admittedly foolish question.

"What inventions does the world most need to-day?"

"The world doesn't need more just now until general intelligence has increased so men can be had to operate what we have."

Edison was a bit tart in the last answer and seemingly contradictory, too.

(Continued on page 133)

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 132)

of his own effort to give the world more new things. But I am glad he poked us on our general intelligence. He once told me that man needed to develop about two more twists or convolutions of his gray matter. Also I deduced from that answer that there is a shortage among us of real brainy mechanics and a chance for bright young fellows to qualify as operators of high grade machines.

"How about the American chemical industry versus foreign competition—for example, German synthetic wood alcohol?" I asked.

"American chemical industry is in the making. Germany is still ahead, but not for long."

THE inventor might have added that he himself gave the domestic chemical industry quite a boost during the war, manufacturing benzol, carbolic acid, and a substance that has a name of nine syllables.

"Do you still cut down on sleep, Mr. Edison?"

"No," evidently meaning that the sleep period is now fixed.

"How much do you sleep?"

"Five to six hours. The quality is still perfect."

While ever hostile to sleep, Edison has been wont to lead special campaigns against Morpheus at times when there was a big problem to solve. A member of his famous "insomnia squad" told me about a notable campaign of this sort which took place about a dozen years ago. The problem was to replace the phonograph recording cylinder with a disk of a new, virgin type. For three weeks "the old man" shut himself in the laboratory with a faithful few and never left it, day or night. His food was brought to him; he took catnaps on a cot, totaling perhaps three hours of slumber out of each 24.

At any time he could have been whisked home in a car in five minutes—a fine comfortable home up the hillside in Llewellyn Park—but he had vowed not to leave the scene of action until that enemy problem was licked. His aids were permitted to go home for a little rest, if they liked, after each 36 hours of fighting in the trenches. Overtime pay? Yes. They did get paid in hearing the boss tell endless funny stories of a Chaucerian sort and in working shoulder to shoulder with the greatest human dynamo in the world.

THE boss used to keep a box of good cigars on his desk. He noticed once that they did not last very long and he mentioned that fact to the man who manufactured the brand specially for him.

"I'll tell you what, Mr. Edison. I'll make up some cigars out of rubbish—you keep that box open on your desk for these self-helpers. Keep your own box of good cigars locked in your desk."

So it was done, and shortly afterward the tobacconist asked Edison how the little scheme worked.

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Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 133)

"Say!" exclaimed the inventor, after scratching his head. "The desk box is empty. Guess I forgot and smoked 'em myself!"

The boss often borrowed tobacco from his laboratory men, I was told, using the same 10-cent brand that they liked. One of them set up a tobacco shop in the laboratory for mutual convenience. Edison patronized it to the extent of two packages a week, but overlooked the detail of payment. The employee couldn't dun the boss for casual dimes. Some one advised him to send a monthly bill to the inventor's secretary. He did, and was promptly paid, then and afterward.

WHILE on this anecdotage, I'll include one of the latest going the rounds of the works—which illustrates several things, including the infinite detail that occupies the inventor. At the peak of production the great buildings have housed over 10,000 employees. The story goes that Edison, making his usual rounds, saw a weight on a door on Monday and he sent his usual note, "Weight no darn good. Take it off." It was taken off. On Tuesday he sent another note, "Where is that weight?" It was put on. On Wednesday the boss wrote, "Why hasn't matter been attended to? Weight still there. Why don't you do something about it?" The adjuster of weights took the note to his superior and said: "I can't answer this." The superior said "Leave it to me," and he sent the following to Edison:

"On again, off again, on again, Finnegan.
Monday, Tuesday, Wednesday.
On Thursday we'll take it off,
Friday we'll put it back,
Saturday have it off again
But what the——will we do Sunday?"

Doubtless the boss started to scratch his head over this effusion and then had a hearty laugh, for no one likes a joke better. He "razzes" his men and doesn't mind a return. As far as this door yarn is concerned, I wouldn't be surprised if the weight on and off was an experiment; perhaps a psychological test of a dumb-looking janitor.

I ASKED Mr. Edison about his present diet and he replied:

"I eat very little. The amount of power one can get out of a piece of toast is marvelous. What menu? One and one-half glasses milk, tablespoonful cooked oats, one sardine each meal. Weight constant—186 pounds."

This menu is followed for weeks at a time and it includes all meals. The inventor used to weigh himself every day as a check up on his rations, increasing or diminishing food allowance according to the record of the scales.

"What is your present view of college education?"

"Impracticable," was the terse answer.

Every one recalls the Edisonian strafe against colleges a few years ago and how the higher learning was put to a seemingly

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Edison, at 79, Still Stalks Nature's Secrets

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disgraceful rout under a questionnaire bombardment. That warfare was perhaps embittered by the fact that a number of college graduates were employed in the experimental laboratory. All were suave, hopeful young men, I was told, and when the boss asked them what progress they were making on a problem, they replied that they had just about won. However, on the test, their work usually fell to pieces. This seemed to prove to Edison that colleges merely turned out rank optimists. On the other hand, the self-taught, roughneck members of the laboratory staff were inclined to be more conservative, even pessimistic, on their progress; and when the test came, they often gave Edison a glad surprise.

THE famous questionnaire, comprising hundreds of inquiries on every subject from calculus to cucumbers, has not been used on job applicants for some time. Instead, I believe, the boss gives the applicant a searching visual "once-over." At least he did this the other day to a young chap who was going on the road as a salesman. The young chap said nothing while the boss and his secretary exchanged some shorthand notes; he was just inspected and passed. A while back all employees were disciplined with the questionnaire, save a minority of veteran roughnecks who declined to say whether they had read George Eliot. Nor did these rebels suffer for their attitude.

"Can you give a little advice to young men on how to develop creative talent?" I asked the inventor.

"YOUNG men do not take advice," said Edison gravely, perhaps with a very slight twinkle in his eye. He added "Creative talent apparently cannot be acquired."

Of course we know that millions of young and old men have taken a lot of Edison's advice and they'll keep doing so for a long time to come. He has fairly forced his advice on the world in voice, song, and light. You bet we take his advice! As for creative talent, hasn't he told us we're all due to grow another loop of that gray matter?

My next query was framed to match the apparent tone of his last response:

"Has man progressed mentally in the last 50 (or 5000) years?"

A few years ago I believe Edison rapped out a stiff negative to this very question. You can judge whether he is not now mellower and more hopeful of humanity by this answer:

"Yes. The number of men in every nation, per capita, who are honest, humane, and highly intelligent is increasing. This number is a measure of our civilization. The Lord appears to be in no hurry."

"Will man yet attain a drudgeless world through machines or by tapping the power of sun, tide, or atom?"

"There is no limit to the invention of fully automatic machines," replied Edison. "Man will work less and less."

Snakes Are Safe if You Know how to Pet Them

(Continued from page 27)

"That fat three-footer with the beautiful circular design on his flanks is an urutú. He's an irritable little cuss. Watch!"

Joaquim poked at the snake with his stick, and the reptile instantly struck blindly right and left, without coiling. "He thinks he's a machine gun," said Joaquim. "He strikes so often and so fast that he doesn't bother to take aim. The law of chance is in his favor. The urutú is abundant, and he cripples when he doesn't kill. One of his victims was brought here for treatment. She was totally blind, vomiting blood, shaking with chill, and barely conscious. She had been bitten less than an hour before. You would have said she was already past hope. It took two injections of serum and two days of care to cure her.

"THE boipeva, which also strikes from flat on the ground, without coiling, and the white-tailed jararaca that you see over there, are close relatives of the others I've mentioned, but aren't so common nor dangerous. Your moccasins and copperheads in the United States are allied to these species.

"Now here we come to Mr. Cascavel, the *Crotalus terrificus*, the boicininga—in a word, the good old always-unreliable rattler. We have only one species of rattler in Brazil, compared with the dozen or so that you have in the United States—but our one is quite enough. His venom is five times more active than any other we have studied. He is common and savage; slow to act, it is true, but deadly sure. Our kind friends on the fazendas, or farms, send us as many as two thousand living specimens a year.

"A victim of the rattler should receive serum treatment within two hours, to be safe, and should be watched for as much as three weeks, during which period the dangerous symptoms may crop out again even after an apparent cure.

"There are about 800 known species of poisonous snakes in the world. The rattlers and moccasins and these Brazilian snakes I've shown you are closely related. All have fangs with a hollow tube through which the venom flows. But we have quite another kind of snake in Brazil—those gorgeous little coral snakes that you see over there. They are related to India's devastating cobra. You can see the similarity in shape—long, thin, and graceful, and if you cared to examine their teeth, you would find that their fangs have only a trough, or partially open canal, through which the poison flows, instead of a wholly inclosed tube as in the case of the other snakes you've seen."

I TOLD Joaquim I'd take his word for it about the fangs; but I couldn't help admiring again, just as I often have in the jungles, those dainty little coral snakes, with their brilliant bands of red, black, yellow and white. They are deadly in the extreme—but fortunately their coloring, like a gaudy bead necklace, makes them conspicuous.

Next Joaquim pointed out a long, grace-

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Snakes Are Safe if You Know how to Pet Them

(Continued from page 136)

ful serpent, bluish black in color. "A mussurana," he said. "He is non-venomous himself, and he delights in eating venomous snakes. In five years this one has eaten 112 rattlers and jararacas, some of them bigger than himself.

"Oh, for a long time, we had great hopes of that fellow. We were going to breed him, and scatter his kind all over the fazendas, to slay the other snakes. He is one of the few living things that is immune to the bites of poisonous serpents.

"I'VE seen a mussurana crawl up to a jararaca and unconcernedly twine himself around the latter's body, even though pricked by the poison fangs several times during the struggle. Slowly the mussurana would wrap the larger snake in tightening coils, and finally would get hold of his enemy's neck The latter would hardly even fight—he was relying on his venom to weaken his adversary shortly, as in all his past experience it had always done. But when once his neck was gripped in the mussurana's jaws, the battle was over, and the mussurana was soon absorbing as much of the jararaca as he could hold.

"Apparently there is only one snake whose poison is deadly to the mussurana, and that is the pestiferous little coral

"But our scheme of breeding mussuranas as protectors of the fazendas hasn't worked. We receive very few specimens, and we can't keep many of them alive in captivity. For a time we flirted with the idea of using wild hogs to fight snakes. They too are nearly immune to venom, but for a different reason. It is simply that they carry so much fat that the poison rarely gets through it to a vital spot. And they like to eat snakes. But the planters won't have them around, for they destroy crops as well as serpents. Now we have another white hope in the national offensive against serpents. It is this little Brazilian skunk, which seems to be a natural born snake slayer. I'll show you"

THE skunk was put into an inclosure with a cascavel. He approached the rattler, sniffed it, and was promptly bitten three times. We could see the blood from one bite on his nose, and even a trickle of the over-abundant venom The skunk meditatively raised a paw and wiped the injured nose—then decided he was hungry. So without more ado, he simply bit off the rattler's head and ate it with relish, poison glands and all.

"He won't suffer a bit from that poison," said my guide. "Yet any one of those three bites would have slain you. The skunk is blessed with immunity—and I don't think science really knows what *that* is. Each snake is relatively immune to the bites of others of the same species. The amount of rattler venom necessary to kill another rattler, will kill 10 snakes of other species, 24 dogs, 60 horses, 600 rabbits. I don't know how much venom would be necessary to kill one of these

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Snakes Are Safe if You Know How to Pet Them

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skunks. We hope that ultimately they may prove to be a valuable ally in the war against snakes.

"But today the only real hope is the serum. The way we make it is fairly simple. The venom is extracted by holding a snake and forcing him to strike with his fangs on a glass vial, which receives about half a teaspoonful of the poison. This is diluted and otherwise treated, and then injected into the horses that we keep for the purpose. Doses growing gradually stronger are given repeatedly for about six months. By that time the horse's blood has developed an extraordinary resistance to the poison. We draw off then about six quarts of his blood and from this the serum is made.

"INJECTED into any snake-bite victim, this serum apparently neutralizes the effect of the poison until the victim's own glandular system has time to rise to the emergency and conquer the poison.

"You often have read of many methods supposed to cure snake bite. Making a ligature, sucking out the venom, taking brandy and cathartics, and keeping the puncture open with a packing of sterile gauze all are recommended. Down here, from repeated experiment, we are convinced that all the familiar recipes are quite futile. The snake venom fixes itself on the nerves, in the tissues and blood, with devastating rapidity. Once you are bitten, it is too late for any cure except serum.

"All reported cases of cures by these other methods mean merely that the snake was not a poisonous species, or else that his fangs did not administer a normally fatal dose.

"Our daily association with snakes here has upset a whole raft of superstitions. Snakes will not pursue you. They will not attack you unless disturbed. They cannot leap through the air, as our natives firmly believe. They cannot hypnotize anything. We have repeatedly tested on birds, rats, and toads this widely credited hypnotic power of snakes, and we know they have no such power.

"ANOTHER superstition has grown up around the snake's forked tongue. Not only our natives, but many educated people think that that flashing pink tongue is a poisonous sting. As a matter of fact, it is nothing but a feeler, and is utterly harmless. The two fangs, which fold back when the mouth is closed, and spring down into striking position when it is open, are the only weapons the snake has.

"Here, help me hold this rattler a minute, and I'll show you—" There Joaquim went again, picking up snakes! I'd had enough. I told him that I must go to keep an engagement with wild Indians in the jungle.

I've learned today that you are perfectly safe with snakes if you have plenty of serum, and wear leggings and gloves, and know how to handle the reptiles. But I rather suspect that you can be still safer by not handling them at all.

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Lessons in Magic

(Continued from page 18)

Do this a few times when all six papers are attached. Then, when you remove one, raise the knife, apparently as before, but as the point comes up, push your thumb slightly in the direction of the point of your forefinger. This will give the knife a half turn that will not be detected, but will let the audience see only the side of the blade that was visible when the knife was held in the lowered position.

When you bring the knife down, of course, you pull your thumb in the opposite direction so that the half turn is reversed. With a little practice you should be able to show either side of the knife at will.

ANOTHER little "table trick": Take a lump of sugar from a bowl, roll it out on the table and challenge any of your companions to set it on fire. When several of them have held matches to it unsuccessfully, you take it, or another lump, hold a match to it, and immediately the sugar begins to burn.

The trick here lies in applying a tiny speck of tobacco ash to the sugar. You may do this either by letting the lump of sugar carelessly fall to the table or to a plate where you have placed a speck of ash, or by rubbing a little ash against the sugar with the end of your finger. The smallest bit is sufficient to start the sugar burning when you apply the match, for the ash and the sugar form a fusible chemical compound.

This is as far as I would advise any amateur to go in performing chemical tricks, for such tricks may cause serious accident and injury to a person who has not a thorough knowledge of chemicals and their effects. I have just received a letter from the sister of an amateur magician telling me that her brother had blown off one of his arms while mixing a flash powder of phosphorus and potash, and asking me to warn others against playing with powerful and dangerous chemical combinations.

THERE are a number of pretty and amusing effects to be obtained by folding and tearing paper. One of the best of these is what is called a "Jacob's Ladder." Fold the short edge of a sheet of newspaper to form a little "hem" of about half an inch. Roll the sheet down its length loosely into a cylinder about 1½ inches in diameter. When six or eight inches from the end of the roll, insert another sheet of newspaper and continue rolling.

Continue this process until your roll consists of 10 or a dozen sheets, or more, if experiment shows you that you can handle them. Be sure, though, not to make the roll too tight.

When you have completed the cylinder, flatten it down and tear out a piece as shown in the drawing on page 18. Fold down the ends as shown, flattening the center piece and smoothing all wrinkles out of the two ends. Take hold of the little hem in the center of one of the cylindrical ends and pull. Alternately pulling on the hem in each cylinder, draw out the "ladder" to its full length.

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Lessons in Magic

(Continued from page 140)

If performing this effect unaided, it may help you if you put rubber bands about the cylindrical ends to prevent them from unrolling. Or you may ask some one to hold the ends for you, and then pull out the "ladder" by taking the hem in each cylinder in your fingers and backing away.

THE ladder, of course, need not be made with newspaper. You can use rectangular sheets of almost any size—pages from a magazine, typewriting paper, colored paper; whatever happens to be at hand. The greater the number of sheets, of course, the longer the ladder; the limit is determined only by the number your fingers are strong enough to tear

These tricks, although more or less elementary, are, every one of them, most effective if artistically performed. Remember that misdirection is the secret of every magical illusion. Divert the attention of your audience from what you are doing, particularly at the critical moment in your trick A most effective aid in bringing this about is bright patter, so, if you are to succeed as an amateur magician, you must acquire the ability to talk rapidly, continuously, and interestingly.

Self confidence to the point of brazenness is another attribute that the successful magician must have. You can never put over an illusion if you attempt to do so in a timid, bashful manner. And self confidence will come only from the consciousness of skill, won by patient, ceaseless practice.

From the Editor's Mail

WHY do you read POPULAR SCIENCE MONTHLY? What articles interest you most?

The following letters are typical of the hundreds that come from our readers every month, telling us of the pleasure and profit they derive from reading POPULAR SCIENCE MONTHLY

Won't you write, too, and tell us just what you think about this magazine?

What an Inventor Says

I am a man who has been inventing since I was 18 years old, and today I am 46 years old. I have read a good many magazines concerning inventions, but POPULAR SCIENCE MONTHLY is about the best I have read.—P K., Mamaroneck, N. Y

No More Haphazard Buying

Kindly send me the list of tools which the Popular Science Institute of Standards has tested and approved. I, for one, can appreciate such service as I often have bought tools only to discard them as worthless.—J. W., Evergreen, L.I., N. Y

Wouldn't Miss an Issue

I have been taking POPULAR SCIENCE MONTHLY a long time and wouldn't miss an issue. B. A. H., Montreal, Can.

Interested in Astronomy

I subscribe to your magazine because of your astronomical articles.—W D U, Niagara Falls, N Y

What a Cleaner Has Learned about Your Clothes

(Continued from page 24)

electric machinery, you have much to do with fluids for storage batteries, fluxing materials for soldering, and various metal polishes. And if you are a plumber, guard your clothes against mineral acids and soldering solvents.

OUR spotters, in tackling stains, are more cautious in their procedure than the average man or woman who tries to remove spots at home. When we cannot identify a spot, we follow a standard procedure for unknown stains. This is to avoid "setting" the spot beyond remedy. We use in the order given: Dry solvents, wet solvents, semi-dry solvents, reducing agents, and oxidizing agents.

Even then, special problems frequently occur.

For example, we were swamped one day recently with 3000 men's shirts, sent by a shirt concern. Every one of these had been accidentally stained with dark varnish during building alterations. They were of various fabrics and colors. To insure a process that could safely be used, we sent samples of the shirts to our expert chemist, who made exhaustive tests.

These tests showed that a method that proved successful with the silk shirts changed the color of the cotton shirts. In the end, we had to adopt three entirely different processes—for the white shirts, for the colored silk and for the colored cotton shirts.

New facts are constantly being learned in the science of removing stains, as in every other line of work, and new formulas for spotting solvents evolved. Glycerine, for example, formerly was used far more extensively than it is now, and ammonia was for many years looked upon by the earlier dry-cleaners as a cure-all.

JUST as a physician hesitates to order his patients to take care of their own small ills, so I would hesitate to suggest that people try to remove spots and stains from their clothing themselves. Yet there are a few methods for removing common stains that I think every one should know. They are:

Fatty grease stains: On wash goods use warm water and soap; but on delicate fabrics use carbon tetrachloride, which may be bought in any drug store under various trade names. On fabric likely to be injured by water, use absorbents, such as blotting paper, fuller's earth, French chalk.

Paint: Try to remove paint stains only when they are fresh. If the material is washable, plain soap and water will remove them. Otherwise, sponge the fabric with pure turpentine. If paint is hardened, send to the dry-cleaner.

Axle grease, mineral oils, pitch: First rub with vaseline, then apply carbon tetrachloride.

Tobacco: Apply warm glycerine when the fabric is colored; hot dilute alcohol to white fabrics (but not to artificial silks).

(Continued on page 143)

What Could You Do with $50—?

See the Cash Prize Offer on Page 4.

What a Cleaner Has Learned about Your Clothes

(Continued from page 142)

Coffee: Use soap and water (not hot); then, if necessary, potassium permanganate.

Mud: Let dry and brush thoroughly. Sponge with alcohol (but not if artificial silk).

Water spots: Dampen the entire garment, and press while still damp.

Since people took to soft drinks, and to staying home evenings for radio concerts, and to going away for week-end auto trips, we've had to cope with stains that were unknown to our predecessors 50 years ago.

A WHITE georgette wedding dress was brought to us by a young bride one day last winter. She had worn it two or three times, and wanted it cleaned, so that she could pack it safely away.

The dress appeared slightly soiled, but otherwise spotless. However, when it came through the dry cleaning, we found a yellowish stain on one of the panels. Nothing would remove it. We finally sent the panel to our chemist for a report. Ginger ale or some other soft drink, spilled on the dress, and perhaps unnoticed at the time, was found to have been the original cause of the trouble. If the young woman had told us of this in the first place, we easily could have removed the ginger ale by water brushing. As it was, an entirely new panel had to be sewn into the dress.

People did not chew gum a century ago, nor drink malted milk, condensed milk, or even pasteurized milk. They didn't know the taste of ice cream. Indelible ink, road oil, perfumes, battery acid, lipstick and rouge—these, too, are leaving the fingerprints of twentieth century civilization on our clothing. The dry cleaner receives this by-product in the form of new stains, to the removal of which he must apply all the ingenuity and chemical knowledge at his command.

ADVANCES in the industry have given the dry cleaners an equipment consisting of machines to cleanse the garments in the solvent (washers); machines to remove this solvent from the cleansed garments by centrifugal action (extractors); and machines to dry and deodorise the garments (tumblers).

A recent revolutionary step in the industry was the introduction of the so-called "continuous flow" system. This made an automatic "clarifier" an integral part of the cleansing process. The solvent now flows in a continuous passage from the washer to the clarifier and back to the washer—returning as a cleansed solvent. This has eliminated the laborious and repeated rinsings in fresh loads of solvent.

An even more recent innovation is the introduction of a semi-nonflammable solvent, a heavy petroleum with an initial boiling point of from 280 to 300 degrees F. and an end point of from 400 to 420 degrees. If generally used, it is hoped that this solvent will considerably decrease the number of explosions and fires in dry-cleaning plants, and protect the lives of the operators.

What 10,000,000 People Like to Hear on the Radio

(Continued from page 64)

"Of course, there are freak letters coming in all the time," he continued with a smile. "If our chief announcer were not already married, he could have had a wide choice in wives from among the number of feminine listeners who have fallen in love with his voice and actually proposed marriage by mail, sight unseen! Then there are the listeners who send in presents as a mark of their appreciation. Everything from a peck of extra large potatoes to a pair of fireman's heavy, red suspenders elaborately embroidered!"

Although talks and lectures do not seem to be rated very high on the scale of what the modern listener likes, this certainly does not apply to such features as morning health exercises.

THE director of the largest morning gym class in the world, who gets enormous numbers of men and women out of bed at 6.45 every morning just to exercise according to his instructions over the radio, told me that in the last year he had received upward of 100,000 letters from radio listeners who stated that they were consistently following his course.

It is estimated that not 10 per cent of radio listeners ever write to a broadcast station, so it is easy to make a pretty good guess as to the actual number of people who follow his course.

And that they are greatly benefited is shown by letters such as this:

> You stated over the air this morning that you would like to hear from your radio audience regarding loss of weight through doing the exercises you broadcast every morning. I am very much pleased to be able to report progress in that direction.
>
> On March thirtieth last, I weighed 205 pounds and was getting one of those things that keeps a fellow from seeing his shoes. June fifth I weighed 198, July first, 191, August first, 189, and September fifteenth, 180. In other words, I lost 25 pounds in 5½ months. Don't you think this gradual reduction is all right? I am now just about what I should weigh for my height and age.

The public wants entertainment by radio. They have received medical treatment by radio, and now they lose weight by radio.

Recent Publications

The Marvels of Modern Physics, by Joseph McCabe. Atoms, electrons, wireless electricity, and other wonders of physics explained. Illustrated. G. P. Putnam's Sons.

Our Insect Friends and Foes, by William Atherton Dupuy. Interesting stories of everyday insects. Illustrated. The John C. Winston Co.

The Engines of the Human Body, by Sir Arthur Keith. The human body explained from the viewpoint of a mechanical engineer. Illustrated. J. B. Lippincott Co.

Automotive Repair, by Homer J. Smith and Roy S. Kern. Working manual for students, automobile owners, and repair men. The Manual Arts Press.

How to Paint Your Car

(Continued from page 66)

for—one priming coat, then two coats of paint and a finishing coat of varnish. The first three coats have to be rubbed down with pumice stone or fine sandpaper and the car gone over with a tack rag. If I tried to do a real high class 'coach job' with many thin coats, we'd be snowed under with the spring repair work before I could get it finished. Besides, I'd get tired of leaving the car here while I walked home every day."

THE bookkeeping end of the business at the Model Garage, which Joe took care of, being light just then, Joe had considerable time to spare. He pitched in to help Gus with the sandpapering and dusting.

"Just see how easy it is to get the paint nice and smooth with this brush," Gus pointed out, when they had smoothed down the priming coat, and he began to apply the second coat.

"That's because you are using good paint," said Joe.

"Sure it's good paint! Didn't I mix it myself? But if you'll take a good look at this paint brush you'll see why the paint flows so smoothly. That's no 39-cent bargain sale brush made out of pig's whiskers stuck in the handle with glue. No, sir! It's pure badger hair set in rubber, and I'd hate to tell you how much money I parted with to acquire it," Gus stated with the enthusiastic pride of a good workman in a fine tool.

"So the brush makes a lot of difference, does it?" Joe asked with interest. "Why, I thought that anything with bristles in it would do. I'd have used a cheap brush that I could afford to throw away after I'd finished and save myself the trouble of cleaning it."

"THERE'S where you're all wrong," said Gus with emphasis. "Cheap brushes may be all right to use on a cowshed, but you can't do a really fine job with 'em. They simply will not flow the paint on smoothly, and you spend half your time picking off the bristles that keep coming out of the brush."

By the end of the week, the first three coats had been put on. Gus made sure that each coat was thoroughly dry before he applied the next one. Of course, each coat was sandpapered lightly and Gus and Joe spent a lot of time on the dusting.

"Now comes the hardest job of all," Gus announced the morning after they had finished sanding and dusting off the third coat of paint. "Today I'm going to flow on the finish varnish coat, and I'm going to have it absolutely smooth and glasslike all over or bust a leg trying!

"Get the oil stoves going, Joe, while I wet down the floor and walls so that walking around won't raise any dust. Then when the temperature is up to 70 degrees you can go outside and see that nobody races a motor in the garage or does anything else that would be likely to kick up a lot of dust or jar any down from the ceiling."

(Continued on page 146)

How to Paint Your Car

(Continued from page 145)

"Why be so fussy?" said Joe. "What little dust you might get on the car by walking around won't hurt the varnish any."

"Don't you believe it," Gus stated decidedly. "That's why most amateur jobs look so punk. The least bit of dust on the varnish, and the bird who did the job has to tell all his friends that it looks fine if you stand 20 feet away!

"Just to be sure, I'm going to strain this varnish through a piece of that cotton cloth. Then, if there are any lumps or particles of grit in it, they won't have a chance to show up like warts on the finished surface."

Joe followed Gus's instructions so literally that he made two customers shut off their motors at the door and pushed the cars inside by hand.

The next morning Gus, with a great deal of pride, invited Joe in to see the result of his handiwork.

"THERE!" he said. "That's pretty durn near as good a job as any professional auto painter could turn out."

"Sure looks swell," admitted Joe admiringly, as his eyes traveled over the smooth shining surface—no trace of dust or a brush mark anywhere.

"We ought to go into the auto painting business if you can do as good a job as that," he suggested. "By the way, I was looking over my flivver last night, and as far as I can see, the paint is perfectly good, only it's kind of dull. Could I freshen it up if I put a coat of finishing varnish on it?"

"If the paint isn't cracked or checked you can do a good job that way," replied Gus. "These quick drying auto enamels are pretty good for such a job, but you must be just as careful about dust as if you were trying to apply coach varnish. That's what most of the enamels are, anyway—high grade varnish with color added. Only be sure that you buy the best grade you can get; some of the cheap grades show white when the car gets rained on and they begin to look shabby before a month has gone by.

"Don't forget the heat, either. There was a fellow I know who put on a coat of one of these one-day-drying auto enamels in a cold garage in the middle of winter. It took nearly a week to dry and meanwhile dust blew in through the cracks in the door. That job looked like it had been done in a concrete factory.

"And as for going into the painting business—nothing doing! I'd rather pull down three transmissions and four rear ends than do one paint job. I'm an auto mechanic—not a painter."

"This bus is finished now," he declared, as he started in to clean up his brushes. "We'll let it sit there for a couple of days and then I'm going to shower it down with cold water to set the surface of the varnish. Then I'll wipe it off with a piece of chamois skin and after that I'll roll down Main Street thinking I'm fooling everybody into believing that I have a new car!"

Is Your Memory Really Bad?

(Continued from page 27)

who have remarkable memories for sport statistics. They can tell you football scores and baseball batting averages without end. They don't learn these facts to show off, but simply pick them up because they are interested keenly in athletics.

When I went to Amherst, the president of the college was famed for his memory. It was said that once he had met a student, he never forgot that student's name, no matter how many years intervened. The secret was profound attention. He made it a point to have a 15- or 20-minute interview with every freshman. I remember all the while I was in the office he was studying me closely. First he made sure to get my name correctly. During the interview he used my name five or six times. As a result, at the end of the 15 minutes he had my name and had it linked to my personality.

DO YOU find it hard to remember names? If you do, this repetition trick will help greatly. When some one introduces you to Mr. White, say, "Oh, yes, Mr. White. I'm glad to meet you, Mr. White. A relative of the Whites of Chicago? No? Mr. White, there, is a good friend of my father."

Punning on names helps, too; remembering names by their resemblance to the names of animals, familiar objects, and so on; but don't try this with strangers right off the bat. If you can slip the name into a classification, that will help, too. Some names sound aristocratic. Other names indicate immediately a certain nationality. Recalling that it was a name of Irish origin would help in bringing back the name of O'Brien. The name may be that of a color, such as Green or Gray, or you may think of other possible groupings.

Mechanical aids help in improving your memory in special lines. Make up little stories that link the facts together.

Thus, in a comparative word-memory test, such as is shown on page 26, you are given a list of words in pairs, then later given one of each pair and asked to recall the other. The easiest way to remember these is to establish a story connection. Suppose the words are "dark" and "toe." "The man stubbed his toe in the dark." This little story serves to link the two words so that later you can recall them together.

YOU probably have not a few facts in your mental storehouse that you recall by means of doggerel. You may, for example, remember the date of the discovery of America by using the old rhyme, "In fourteen hundred and ninety-two, Columbus sailed the ocean blue." And no doubt you remember the months that have 30 days by the familiar, "Thirty days hath September" jingle.

Such mechanical aids are useful—provided, of course, that they are not so complicated as to make remembering the method more difficult than remembering the facts themselves would be. While on the subject, I recall a shorthand version of the "Thirty days hath September"

(Continued on page 148)

Is Your Memory Really Bad?

(Continued from page 147)

sequence. It is the single word "apjunseno," made up, as you can see, by combining the first letters of the names of each of the 30-day months in the order of their occurrence.

I know some persons who remember telephone numbers by making words of them. Each digit has a corresponding consonant. Between the consonants they fit vowels and make a word that is linked to the person's name. For instance, Mr Brown's telephone number is 5170. Suppose the consonants corresponding were g, b, l, and n. Think of the word goblin. A brown goblin—there you have it.

A GOOD way of compiling the code that corresponds to the 10 digits is by selecting letters that resemble in some particular the numbers for which they stand. Thus *l* might equal one; *n* (two upright lines like the Roman numeral two; *m* (three lines) three; *r* (last letter of name of number) four; *v* (Roman numeral) five; *p* (resembles the number inverted) six; *L* (capital resembles the number) seven; *sh* (arbitrary choice) eight; *g* (written, resembles the number) nine; and *z* (first letter of name) zero.

Such a code has the additional advantage that the sounds are not repeated, and consequently any word formed from the letters will stand for one set of numbers and one only. By this system the number 1002 would become l-s-s-n, suggesting the word "lesson"; the number 8640, sh-p-r-s, suggesting "shippers."

One man who makes many public speeches locates each successive "point" of his speech in a corner of the hall or in a room of his own house. Then when he has finished one point he looks in the next room and this instantly recalls the next point of his speech.

Last year there was a young Lithuanian at Columbia University who astonished every one with a remarkable memory demonstration. He could state correctly from memory the logarithms for figures from one to 100, and could call off any of 300 numbers previously arranged in a list, when only their location in the list was indicated. It was understood that the young man had prepared for his exhibitions by memorizing the list. Even so, it was an impressive stunt.

HE EXPLAINED that he did it by associating the numbers with various colors of the spectrum and that his powers were exclusively visual. He merely translated colors that he saw back into numbers.

Supposing you have carefully organized the material that has gone into your brain. Your background of information, your ability to think of things in large units, your interest, attention, and repetition have helped to make vivid impressions. You have a healthy brain, so you let the process of retaining facts take care of itself. The only thing that remains is recalling the facts stored away.

This, too, will take care of itself if you will remove all distracting elements, the chief of which is emotional disturbance—fear that you will forget. I shall never

(Continued on page 149)

Is Your Memory Really Bad?

(Continued from page 148)

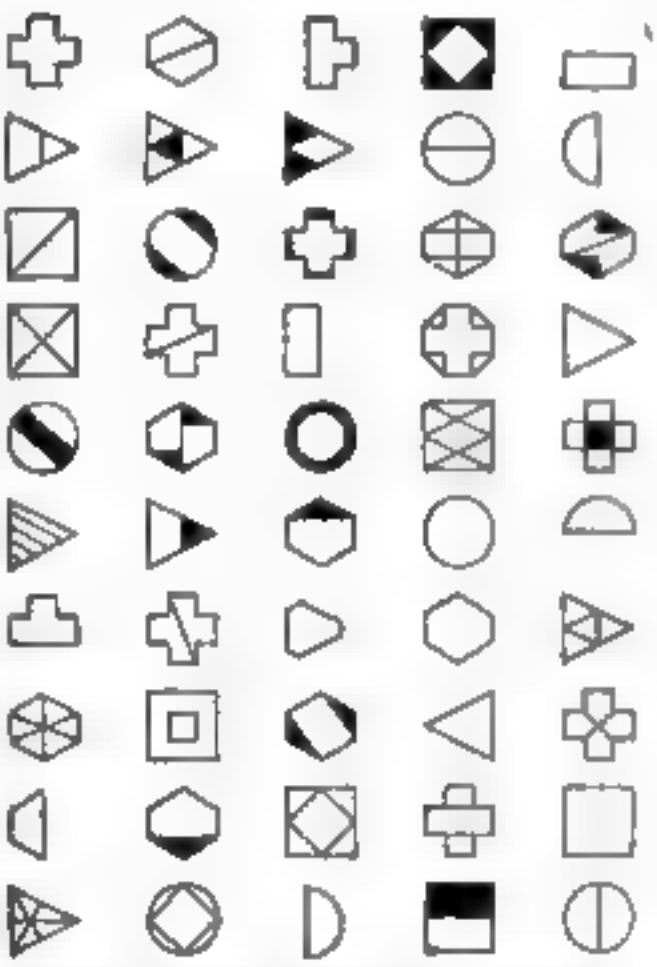
forget the appalling sensation I once experienced on the platform in high school as I waited my turn to give a speech. I was sure I should forget. I did not forget, but the task would have been twice as easy if I had had confidence

If you can't remember something at first, drop the whole matter and come back to it later. It means that certain connections are established in your brain over the wrong paths. If you back off and rest a while, the wrong track will fade out.

Trust your memory and go right ahead If the connections are established properly, they will function with ease.

Memory tests concocted in psychologists' laboratories have practical use right here. In themselves they do not improve memory, but they do develop self confidence. Try them on yourself. They will show you that there is nothing the matter with your memory. Your problem is to become a better manager.

The Picture Test



AMONG these 50 forms are hidden the 25 forms shown at the top of page 26. Check as many of the 25 as you can remember. Score one point for each that you remember correctly, and deduct one for each that you mark wrong.

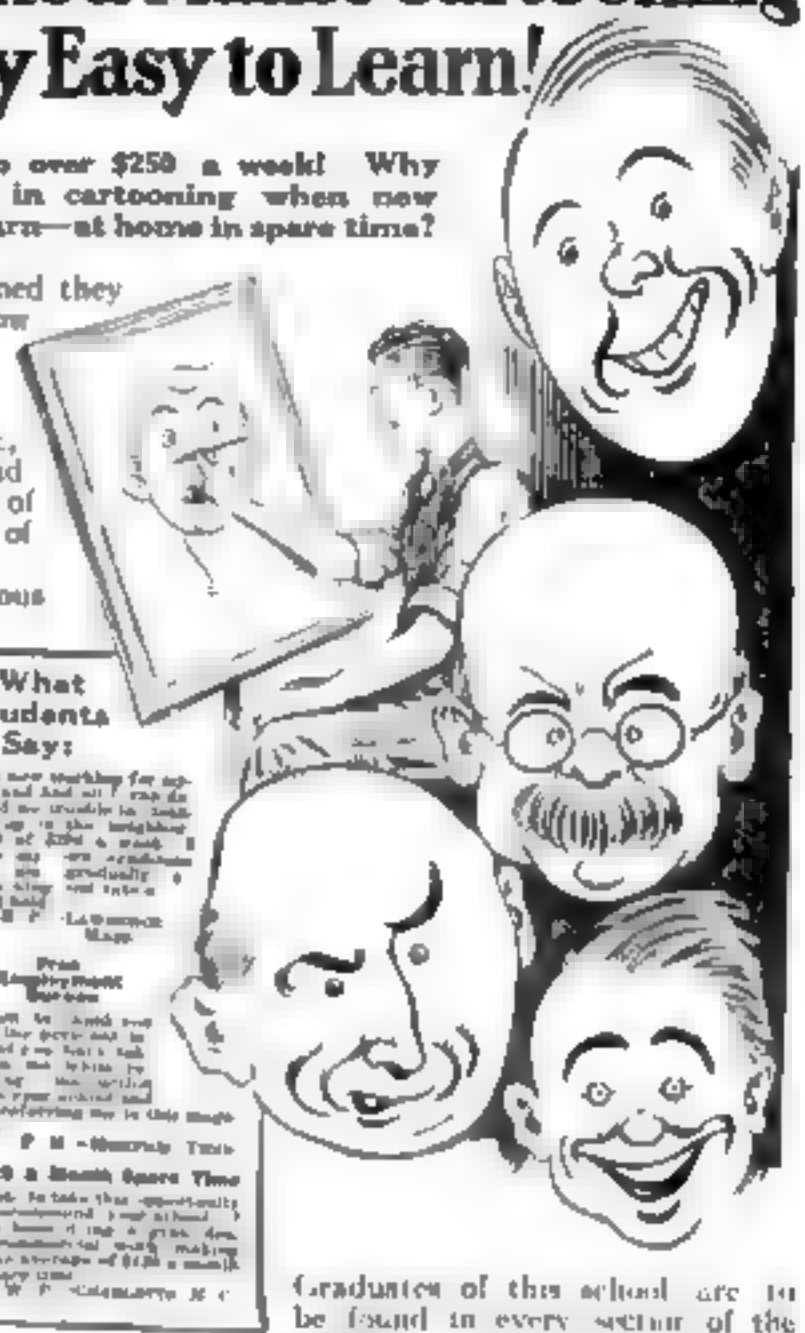
The Word Test

OPPOSITE each of these 10 words write from memory the word with which it is paired on page 26. See how many you can recall.

Prefer
Overcoat
Tiger
Freeze
Fish
Sickness
Table
Parlor
Expensive
Unfair

How New Method Makes Cartooning Astonishingly Easy to Learn!

Cartoonists earn from $50 to over $250 a week! Why don't you make big money in cartooning when new method makes it so easy to learn—at home in spare time?



THOUSANDS who never dreamed they could make cartoons, can now earn big money in this fascinating field. Right at home in your spare time, you can now easily learn to make all kinds of cartoons—comic, sport, political, human interest and animated. You can now earn some of the big money paid for cartoons of every description.

And cartooning *does* pay enormous money. Briggs, Bud Fisher, Fontaine Fox, George McManus, Sid Smith and all the other head-liners *earn more than the President.* A single cartoon idea can easily mean a splendid life-salary for you.

The World's Easiest, Pleasantest and Best Paying Profession

How could money be earned more pleasantly? A few hours a day at work that is as enjoyable as play and there is almost no limit to the money that can be earned!

Never before have the opportunities in cartooning been so many or so varied. Never has there been such a splendid chance to earn big money for cartoons. And regardless of what you are doing at present or how poorly you draw now, you can easily and quickly learn to make cartoons thru this new easy method.

New Easy Way to Learn Cartooning

It's fun learning to make cartoons this new way. It's just like a game. You learn at home, yet it is just as if an instructor stood at your elbow. You don't need to know a thing about cartooning You start with straight lines and curves. Then you learn the little secrets of originating cartoon ideas, the methods of exaggeration, of action and expression—all the little tricks that make cartooning amazingly easy to those who know them And soon you are making *real* cartoons Many of our students had cartoons published before they were half thru their courses.

When learning to make cartoons is so easy, why shouldn't you too make big money and enjoy the fun of cartooning.

What Students Say:

Graduates of this school are to be found in every sector of the country. Read in the panel what they are doing and what they say about this training.

Mail Coupon for Free Book

Learn more about the wonderful opportunities for making money in Cartooning and how this new method makes it easy for you to learn. Read about our students, how they make money while learning, and big salaries after they graduate. Our handsomely illustrated booklet is crammed full of interesting facts about cartooning and describes in detail this remarkable method of teaching Cartooning. It will be sent to you without obligation. Mail the coupon for this booklet now. **Washington School of Cartooning, Room 341-D, 1113 15th St., N. W., Washington, D. C.**

WASHINGTON SCHOOL OF CARTOONING,
Room 341 D, 1113-15th St., N. W.,
Washington, D. C.

Please send me without obligation your Free Booklet on Cartooning and full details of your new easy home study method of teaching Cartooning. **(PLEASE WRITE PLAINLY.)**

Name .....
(State whether Mr., Miss or Mrs.)

Address .....

City ..... State .....
(If under 16, please give age)

$100 in Cash Prizes

See Page 4 in front of book for details

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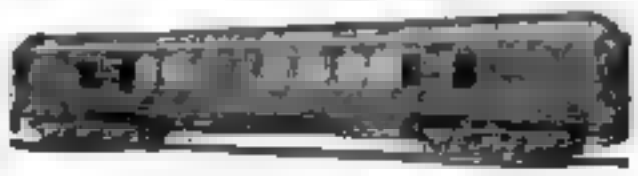
$1700 to $3000 Year

TRAVEL—See Your Country

MEN—WOMEN, 17 UP SHOULD MAIL COUPON IMMEDIATELY

Steady Work. No Layoffs. Paid Vacations.



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Sirs: Send me without charge (1) Specimen Railway Postal Clerk Examination questions. (2) FREE book containing list of U. S. government positions open to men and women. (3) Free sample examination coaching.

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Address .....

THE DANGER OF NERVE EXHAUSTION

Your Nerves can make or break you!

THERE is but one malady more terrible than Nerve Exhaustion and that is its kin, Insanity. Only those who have passed through a siege of Nerve Exhaustion can understand the true meaning of this statement. The victim passes through the most soul-racking tortures he is in the grip of every conceivable fear.

Nerve Exhaustion is the result of living under conditions of nerve strain. In men it can generally be traced to the strain of business worries and responsibilities, and, more frequently, to excesses. In women, to over-active emotions—particularly in matters of love and marital troubles.

Indeed, we are ALL living under severe nerve strain. We go about the business of bread-winning with a mad intensity, and, in the same way, we go about our pleasures. This is an age of nerve strain and no one is strong enough to be immune to its devastating effects.

PAUL von BOECKMANN

Author of "Nerve Force" and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects.

Nerve Exhaustion does not come suddenly. It creeps in like a thief in the night and you do not know it is there till you are actually in its clutches. When the first symptoms of this malady are upon you you pay little attention. It is not considered unusual to experience fatigue, lassitude, headaches, nervousness and other symptoms. Yet surely they will not stop there. Other stages of Nerve Exhaustion will follow: sleeplessness, irritability, poor assimilation and digestion, constipation, irregular heart, etc.

If your nerves keep them so by learning how to live right. If your nerves are deranged build them up.

Do not wait until the final stages have developed and you are told by your doctor to take a "long vacation" or confined to your bed for months of "rest" with drug stimulants and sedatives to keep you from "jumping out of your skin." The time to act is when you are advised that "there is nothing the matter with you"—except nerves—and yet you KNOW THERE IS SOMETHING THE MATTER.

Nerve Trouble or no nerve trouble, you should have a knowledge of the functioning of your Nervous System.

Read "Nerve Force," a 64-page book on the care of the nerves. This book is a startling revelation to people with sensitive or deranged nerves. It has aided many thousands to gain control of their nerves and build up their Nerve Force. Price, 25c postpaid. (Coin or stamps.)

Address PAUL VON BOECKMANN
110 West 40th Street, Studio 161,
New York City

Here Are Correct Answers to Questions on Page 41

1. During the first six months. The increase in height is usually about five per cent a month. In weight it is about 20 per cent a month.

2. They contain an oily chemical that evaporates, very irritating to the delicate membrane of the eye. The watering is an attempt of the eye to wash away the irritation.

3. Precious stones are merely crystallized minerals. They are formed in rocks by slow crystallization of the proper mineral.

4. When the gun is fired, the powder turns into gas. The gas takes up much more room than the powder did and that is what drives the bullet out of the gun. When the bullet leaves the gun, the gas behind it escapes suddenly and sets up a sound wave. This is what we hear as the bang.

5. A broadcasting station does not send out merely a wave corresponding exactly to the sounds that it intends to broadcast. Instead, the fundamental thing that the broadcasting station sends out is a radio wave of uniform frequency, this frequency being the specified one for that station. This fundamental wave is called the "carrier wave." The sound message is superposed on it.

6. The water inside the living cells freezes and this bursts the cells so that they die.

7. It is made of nitroglycerine mixed with some absorbent material, as clay or sawdust. The atoms of nitroglycerine are fastened together very loosely. On the slightest provocation they fly apart and the nitroglycerine explodes violently. The clay or sawdust divides up the nitroglycerine so that it is not quite so violent. This makes it safer to handle.

8. When a cat is frightened or angry he ruffles up the hair of his body and tail in order that he may appear to be more dangerous. The cat does this by a chemical discharged by his adrenal glands.

9. Strictly speaking, there is not; though at the center of the earth things would weigh very little. Weight is due to the attraction of gravity. At the center of the earth the attraction due to the matter of the earth would disappear, but there still would be some slight weight due to the attraction of gravity of the sun, the moon and the other heavenly bodies.

10. Because when it was formed the matter that gathered together was revolving, probably because the attraction of the passing star started it off. The earth has simply kept on spinning as a top would spin if there were no friction of any kind to make it stop.

11. A scorpion, not very different from modern scorpions. In the Silurian period, four or five hundred million years ago, there were a lot of scorpions living in the ocean. Some of them finally learned to live ashore.

12. Very few people take exactly equal steps with their two legs. In ordinary walking we correct this automatically whenever necessary because we can see where we are going.

Getting Ahead?
Read the advertisements on Pages 120 to 150 of this issue if you want to get ahead!

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

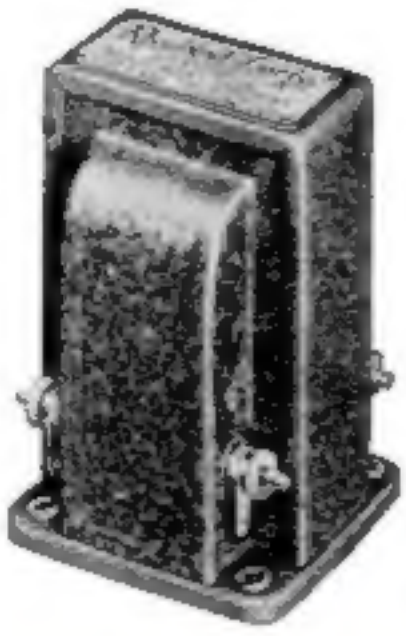
Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 4.

Printed by Art Color Printing Co., Dunellen, N. J.

When a Finer Transformer Is Made It Will Bear This Name-Plate

Radio moves rapidly. Perhaps some time there may be seen a *better* transformer than what we *now* know as Rauland-Lyric. It may sell at $9, or $10, or $15, or $7. But the careful observer of the past year's developments will entertain not a moment's doubt of one thing: when the better transformer comes it will come beneath the famous Rauland-Lyric name-plate. Behind this as a pledge rests the entire organization and resources of the All-American Radio Corporation

Rauland-Lyric is easily obtainable from better-class dealers everywhere. The price is nine dollars. Descriptive circular with technical data may be had on request to All-American Radio Corporation, 4201 Belmont Avenue, Chicago



Rauland-Lyric tone quality is now available in a complete receiver: the new All-American Model R (a five-tube tuned-radio-frequency set) now being shown. If your preferred dealer does not display it, send to us for descriptive booklet

Shave *every* day—be comfortable

COLGATE'S

softens the beard at the base

YESTERDAY

There are logical reasons for the disappearance of the whiskers that used to ripple o'er the bilateral conformations of the manly countenance.

When people invested money in buggies and tin bathtubs it was neither dangerous nor uncommon to display facial outcroppings; but this is an age of speed, and some things cannot conveniently be associated with velocity.

Proceeding at thirty miles an hour, a man with swishing side-whiskers might easily become involved in embarrassing entanglements. With his pilary encumbrances flapping like pennants in a storm, he would offer an immediate challenge to any motorcycle cop who might be inclined to pull him in.

There was a time when the proprietor of a rippling beard was justified in regarding it as a measure of self-defense; but that was when shaving was justly considered a major operation—when there was nothing like Colgate's Rapid-Shave Cream for making lather. The

TODAY

advantage of shaving every day becomes apparent when a picture of the man of affairs balanced between his former side-flaps is brought into contrast with the smart appearance he presents today.

Like millions of others, this man lathers with Colgate's because there is nothing that equals it for putting comfort into shaving. The moist, fine lather, goes to the base of the hair and softens it instantly where the razor's work is done.

There is no need of mussy rubbing in with the fingers. Working up the lather on the face with a wet brush is sufficient to make the heaviest beard yield easily to the blade.

Colgate's leaves the face cool and refreshed.

Let us send you a trial tube of this marvelous cream for better shaving. Please use the coupon and enclose 4c.

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Please send me the trial tube of Colgate's Rapid-Shave Cream for better shaving. I enclose 4c. Jan-26

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A coarse inefficient lather, which fails to reach the base of the hair.

Colgate's fine texture lather, which softens the hair at the base.

Truth in advertising implies honesty in manufacture